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APPENDIX TO THE JOURNALS

OF THE

SENATE AND ASSEMBLY

OF THE

THIRTY-FIRST SESSION

OF THE

LEGISLATURE OF THE STATE OF CALIFORNIA.

---

VOLUME V.



SACRAMENTO:

STATE OFFICE, : : : A. J. JOHNSTON, SUPT. STATE PRINTING.

1895.





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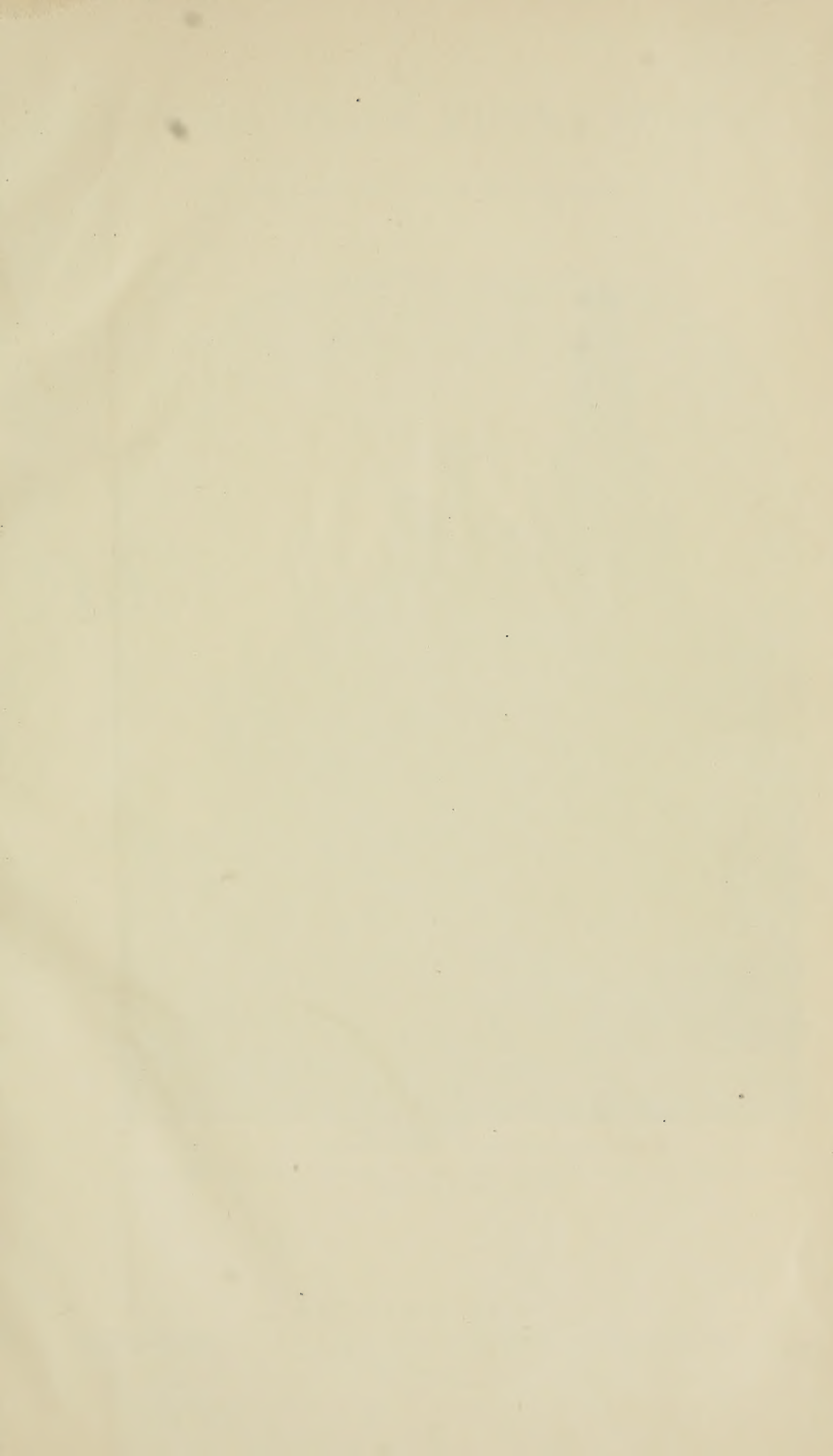
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- 1—Twelfth Annual (Second Biennial) Report of the State Mineralogist. 1892-1894.
- 2—Fourth Biennial Report of State Board of Horticulture. 1893-1894.
- 3—Biennial Report of Board of State Viticultural Commissioners. 1893-1894.









CALIFORNIA STATE MINING BUREAU

Occupies the two upper floors of the NEW PIONEER BUILDING, No. 24 Fourth Street, San Francisco.



# CALIFORNIA STATE MINING BUREAU.

J. J. CRAWFORD, State Mineralogist.

---

## TWELFTH REPORT

OF THE

# STATE MINERALOGIST,

(SECOND BIENNIAL,)

TWO YEARS ENDING SEPTEMBER 15, 1894.



SACRAMENTO:

STATE OFFICE, : : : : A. J. JOHNSTON, SUPT. STATE PRINTING.  
1894.



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*To his Excellency H. H. MARKHAM, Governor of California:*

SIR: The Trustees of the State Mining Bureau herewith submit their report, in pursuance of the Act of the Legislature approved March 23, 1893, entitled "An Act to provide for the establishment, maintenance, and support of a bureau, to be known as the State Mining Bureau, and for the appointment and duties of a Board of Trustees, to be known as the Board of Trustees of the State Mining Bureau, who shall have the direction, management, and control of said State Mining Bureau, and to provide for the appointment, duties, and compensation of a State Mineralogist, who shall perform the duties of his office, under the control, direction, and supervision of the Board of Trustees of the State Mining Bureau."

J. Z. DAVIS.  
W. S. KEYES.  
THOS. B. BISHOP.  
W. S. LYLE.  
J. E. DOOLITTLE.

SAN FRANCISCO, September, 1894.





## REPORT OF TRUSTEES OF STATE MINING BUREAU.

---

Since the issuance of the last report of the Trustees, J. J. Crawford, M.E., has been appointed State Mineralogist, vice Wm. Irelan, Jr., M.E., term expired.

The Board of Trustees, in presenting herewith the report of the State Mineralogist, takes pleasure in bearing testimony to the zeal, energy, and fitness of Mr. Crawford and his corps of field and resident assistants, chief amongst whom is the able and painstaking Secretary and Custodian of the Museum, Mr. H. S. Durden.

The Board wishes also to express their approval of the work of the scientific assistants in the laboratory, Dr. Wm. D. Johnston and Mr. C. G. Schneider, as well as of the minor employés.

### MUSEUM.

The rooms wherein are exposed the collections of the Bureau are, year by year, becoming more and more inadequate to a proper display of the valuable exhibits sent in by the field assistants and donated or loaned by the well-wishers of the institution. Hence, the Director of the museum has been compelled to look more to the improvement of the quality than the quantity of new offerings, and has, with the approval of the Trustees, returned to the lenders quite a number of exhibits not directly and strictly in line with the objects and purposes of the Bureau, bearing in mind always that *practical utility* is what the Legislature required and intended.

The attendance at the rooms, as shown by the register, from the date of the last report up to August, 1894, was 65,985.

There has been added to the exhibits a grand total of 1,038 specimens. Amongst the most noteworthy may be mentioned the following: A large glass model of the underground workings of the Eureka Consolidated mines, Eureka, Nevada, presented by the company and restored gratuitously, where damaged, by Thos. J. Read, M.E. and C.E.

A large model, showing actual method of timbering stopes, drifts, and a three-compartment shaft, by Mr. A. C. Hamilton.

A model of a sluice, as used in hydraulic mining, together with grizzly, undercurrents, etc., by Col. J. E. Doolittle.

A series of ten views of placer mining in California, taken in 1852, and believed to be the only set in existence.

Also a remarkably fine crystal of sulpho-carbonate of soda (Hank-site), presented by Mr. J. W. Searles, of the San Bernardino Borax Company.

### LABORATORY.

Prospectors, miners, and others have availed themselves continually of the facilities of the Bureau for determining new and supposedly useful rocks, earths, ores, and waters. Since the last report, answers have been

sent by letter to 594 inquirers; 2,070 specimens have been examined and passed upon, and 660 determinations have been made to parties who have presented their specimens in person. In addition, many slides have been made for the classification of rock handed in by the field assistants, and between 60 and 70 complete analyses of coal and lignites have been made and published.

#### LIBRARY.

During the period since the last report of the Board of Trustees, but 48 volumes have been added to the library by purchase, owing to the limited amount of funds in hand available for that purpose. By contributions, some 50 bound volumes, mostly geological reports of the different States, and Government publications, have been received, and several hundred pamphlets from scientific societies, and many valuable statistical reports from abroad.

During the period above mentioned some 6,000 volumes of the State Mineralogist's report have been distributed throughout the State to individuals interested in mining enterprises, and about 1,000 to scientific societies and exchanges.

Of Bulletin No. 2, on "Methods of Mine Timbering," recently published, some 4,000 copies have already been distributed and are in active demand, and constitute a valuable and greatly appreciated contribution to the miners of the State.

The number of visitors to the Bureau seeking information and reference to the library is increasing, the monthly average indicating about 10,000 per annum.

The number of letters received seeking information on mining and scientific subjects number some 10,000, all of which were promptly answered and much useful information given to the general public.

#### FACILITIES FOR RECEIVING SPECIMENS.

The Trustees desire again to repeat their sense of obligation to Wells, Fargo & Co., for kindness and public spirit in transporting, free of charge, all packages for the use of the Bureau up to twenty pounds in weight.

#### LIST OF DONORS TO THE MUSEUM.

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 Van Bramer, Jas.  
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 Washeim, Chas. T.  
 Watts, W. L.  
 Webelt & Wilson  
 White, F. L.  
 Wild, Theo.  
 Williamsburgh Scientific Society  
 Wingate & Symonds  
 Wright, J. B.  
 Yetter, Chris.



## MECHANICS' PAVILION—COLUMBIAN EXPOSITION—MIDWINTER FAIR.

A preliminary exhibit of the specimens for the Columbian Exposition at Chicago, State of Illinois, was made at the Mechanics' Pavilion in the city of San Francisco in December, 1892. Early in 1893 an entire carload of specimens was packed, shipped, and delivered to the World's Fair Commissioners at Chicago. This collective exhibit of the Bureau embraced every known mineral product of the State of California, its lignites and rock oils alone excepted. The marble and so-called Mexican onyxes were particularly noticeable. Much to the regret of the Trustees, the specimens were divided between the Mining Building and the California State Building, which, in a measure, detracted from the impressiveness of the exhibits.

A small exhibit of seven cases was made at the Midwinter Fair, in Golden Gate Park in this city. That it was not more extensive was owing not merely to a lack of funds, since the most rigid economy was necessary, but chiefly because the exhibit as a whole, in the museum of the Bureau, was far more attractive, and besides was open to the public, free of charge.

## LIST OF NEWSPAPERS RECEIVED IN EXCHANGE.

We are greatly obliged to the editors, etc., of the following list of papers, which have been forwarded free to the Bureau during the last two years:

Alameda Encinal.	Ferndale Enterprise.	Napa Register.
Alaska Herald.	Four Corners.	New Era.
Amador Dispatch.	Free Lance.	Nevada State Journal
Anaheim News.	Free Press.	Nevada News.
Anaheim Gazette.	Fresno County Enterprise.	Nevada Transcript.
Arroyo Grande Herald.	Fresno Expositor.	Nevada Evening Herald.
	Fresno Republican.	New North West.
Bed Rock Democrat.		Newcastle News.
Blue Lake Advocate.	Georgetown Gazette.	Northwest Mining Review.
Bullion.	Gilroy Gazette.	
Burney Valley Bulletin.	Globe Review.	Oakland Enquirer.
	Gridley Herald.	Oakland Graphic.
Californian.		Oakland Tribune.
Calaveras Prospect.	Humboldt Standard.	Ontario Record.
Calaveras Citizen.	Humboldt Times.	Oroville Mercury.
Central Californian.		Oroville Register.
Chino Valley Champion.	Inyo Independent.	
Citrograph.		Pacific Tree and Vine.
Cloverdale Reveille.	Juneau (Alaska) Record.	Petaluma Courier.
Colfax Sentinel.		Petaluma Argus.
Colton Chronicle.	Lassen Advocate.	Placer Argus.
Colusa Sun.	Lewiston Journal.	Placer County Republican.
Commercial Bulletin.	Livermore Herald.	Placer County Herald.
Contra Costa Gazette.	Los Baños Enterprise.	Pleasanton Times.
Contra Costa Democrat.	Loomiston Journal.	Plumas National Bulletin.
Corning Observer.	Los Angeles Express.	Political Record.
	Los Gatos Chronicle.	Porterville Enterprise.
Daily Tidings.		Press and Horticulturist.
Del Norte Record.	Madera Mercury.	
Democratic Banner.	Mariposa Gazette.	Redwood City Democrat.
Dispatch Democrat.	Middletown Independent.	
Dixon Tribune.	Mining Industry.	Salinas Democrat.
Dunsmuir News.	Mining World.	Salt Lake Tribune.
	Mining Standard.	Santa Cruz Surf.
Eel River Valley Advance.	Mining New Era.	Santa Barbara Morning Press.
El Dorado County Republican.	Mountain Democrat.	Santa Inez Argus.
Escondido Times.	Mountain Messenger.	Santa Maria Times.
Eureka Sentinel.	Monterey Cypress.	Santa Clara Journal.
Evening Herald.		Santa Rosa Republican.
	National City Record.	San José Herald.

San Luis Obispo Tribune.	The Architect.	Watsonville Transcript.
San Benito Advance.	Town and Country (Sidney)	Western Watchman.
Sacramento River News.	Journal.	Weekly Standard.
Selma Irrigator.	Trinity Journal.	Weekly Palo Alto.
Shasta Courier.	Tulare County Times.	Weekly Mercury.
Sonoma County Tribune.	Tulare Register.	Weekly Trinity Journal.
Sonora Democrat.	Twin City News.	Weekly Visalia Delta.
Stockton Record.	Union Democrat.	Weekly Bed Rock Democrat.
Stockton Mail.		Willows Journal.
Stanislaus Weekly News.	Vacaville Reporter.	Wood River Times.
St. Helena Star.	Valley Record.	
Sutter Independent.	Ventura Free Press.	Yreka Journal.
Sutter County Farmer.	Virginia Chronicle.	Yreka Union.
Sidney Mining Standard.	Visalia Delta.	

## FINANCIAL ACCOUNTS.

FROM JULY 1, 1892, TO JULY 1, 1893.

Balance on hand July 1, 1892.....	\$6,803 26	
Paid into Mining Bureau Fund .....	3,102 00	
Bureau appropriation forty-fourth fiscal year.....	10,000 00	
Geological.....	15,000 00	
		<u>\$34,905 26</u>

*Contra.*

Salary of State Mineralogist.....	\$3,000 00	
Salaries of geological assistants.....	9,403 30	
Traveling expenses of geological assistants.....	1,965 50	
Clerical assistance geological work.....	679 75	
Sundries geological work.....	221 80	
Maps.....	3,371 60	
Rent of Bureau.....	3,000 00	
Salaries of Bureau.....	7,755 00	
Library of Bureau.....	405 27	
Laboratory of Bureau.....	106 41	
Freight and express of Bureau.....	255 68	
Minerals and museum of Bureau.....	385 68	
Postage of Bureau.....	219 33	
Sundries: telephone, fuel, water, gas, stationery, etc.....	613 25	
Clerical assistance of Bureau.....	137 00	
		<u>\$31,519 57</u>
Balance .....		3,385 69
		<u>\$34,905 26</u>

FROM JULY 1, 1893, TO JULY 1, 1894.

Balance on hand July 1, 1893.....	\$3,385 69	
Paid into Mining Bureau Fund .....	2,480 60	
Bureau appropriation forty-fifth fiscal year .....	10,000 00	
Geological appropriation forty-fifth fiscal year .....	15,000 00	
		<u>\$30,866 29</u>

*Contra.*

Salary of State Mineralogist.....	\$3,000 00	
Salaries of geological assistants.....	10,645 00	
Traveling expenses of geological assistants.....	3,802 05	
Sundries for geological work.....	381 45	
Maps for geological work.....	193 90	
Rent of Bureau.....	3,000 00	
Salaries of Bureau.....	6,075 00	
Library of Bureau.....	398 28	
Laboratory of Bureau.....	105 38	
Freight and express.....	391 62	
Minerals and museum.....	97 45	
Postage.....	245 37	
Sundries: telephone, fuel, water, gas, stationery, etc.....	509 98	
Clerical assistance.....	100 00	
		<u>\$28,945 48</u>
Balance .....		1,920 81
		<u>\$30,866 29</u>

## REPORT OF THE STATE MINERALOGIST.

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*To the Trustees of the State Mining Bureau:*

GENTLEMEN: In pursuance of the provisions of "An Act to provide for the establishment, maintenance, and support of a bureau to be known as the State Mining Bureau," etc., approved March 23, 1893, I herewith transmit my report for 1893 and 1894, which is the twelfth (or second biennial) report of the State Mineralogist.

It will be noted that the plan of the report has been somewhat changed, and repetitions from the former reports avoided as far as possible by reference to page and volume of previous descriptions of the same properties. Special technical papers have been issued, and others are about ready to be issued, in the form of bulletins, so that only those relating to the general features of mines, mining, or geology are incorporated in the main body of this report. By this means a marked reduction has resulted in the cost of printing, postage, etc., since many desire a copy of the report mainly for some one article specially useful to them. By thus segregating the special articles they may be supplied without sending the whole report.

As the general features of the counties of California, relating to their climate, topography, location, etc., have been so often described in former reports, it has been considered best, in the interest of brevity, to omit all references of this character, except to note the features of progress and establishment of new industries.

Instead of grouping all the county mineral products under the general county title, the following plan has been adopted: The descriptions of mineral properties, such as gold, silver, borax, coal, copper, chrome, lead, magnesite, petroleum, structural materials, etc., are arranged in separate chapters by subjects. Then the names of the counties in which such economic mineral substance occurs, and the names of the mines in such county producing it, follow each in alphabetical order. By this means the reader will be enabled to refer to what he seeks with the least possible trouble, and it may readily be noted just in what part of the State any one mineral substance is being mined. It should be stated that all the "mines" enumerated in this volume are "live" claims; that is, the assessment work required by law is kept up, even if they are not actively worked and producing. It is proper to note, however, that the statement of value of yield of the quartz, sulphurets, etc., is omitted, except where this has been verified by assay in the Bureau.

Many mines have doubtless escaped the attention of the field assistants; but, though it was impossible with the time at our disposal to visit them, it is hoped that, by the time the next report is issued, to obtain a complete list. A lack of funds prevented the assistants from taking the field until the latter part of May, 1893; and this year it was necessary for them to return early in August for the purpose of writing up their notes, and digesting them thoroughly for this report, which is



required by law to be submitted by September 15th. The field work was therefore necessarily curtailed to some extent both in 1893 and 1894. I would earnestly recommend that the Legislature amend the general law so that our *report* might be submitted on the 1st day of December. This would permit our assistants to take advantage of the best season of the year for field work and bring the report nearer up to date.

It is gratifying to note a very marked increased interest in gold mining during the past two years. The unexampled depression in silver mining, due to the decrease in value and the political vicissitudes of that metal, has turned the attention of many miners to the gold mining industry. The success attending the investment of capital in gold properties has been such as to warrant others following the example. The three properties now producing the largest amount of gold per annum in this State are all mines which were abandoned some years ago when the conditions were different, but, being thoroughly equipped and exploited by the investment of capital, were reopened and have attained the position noted.

The principal gold mines are in the northern and central portions of the State. Our annual gold product is largely from the quartz mines. Within recent years there have been so many improvements in methods and systems, that the cost in both the mining and milling of gold-bearing ores has been greatly reduced. As a consequence, gold mines are now worked at a profit which ten years ago could not be operated under the conditions then existing. There are, however, some thousands of "prospects," or undeveloped claims, which need capital for their proper exploitation. Experience has proved that in most instances it needs money to place a quartz claim on a paying basis, and the making of mines out of these numerous prospects is almost entirely a question of the investment of capital. They may prove of value, or valueless, but this can only be determined by work upon them.

The quartz mining industry of California is at present in a better condition than it has ever been before. The speculative features have been to a very great extent eliminated, and careful business methods adopted, resulting in more profitable work and greater confidence of investors. The gold mines of California are to-day in great demand, but this demand is more for developed properties than for mere "prospects" which may or may not become mines. The principal difficulty under which the mining community labors is in obtaining financial aid to develop these unopened claims. The capitalist will not invest until developments warrant an examination; and the prospector is himself unable to open the claim properly. It is for these reasons that there are so many unproductive "mines" in the various counties of California.

It is the object of this report not only to describe the condition of the older and more completely developed mines, but to refer as well to the smaller and less important claims, that attention may be turned to them by those desirous of purchasing such properties. Names of the owners of the mines, with addresses, are given, so it should be no trouble to open correspondence directly with the miners themselves.

The annual gold product of California has remained for some years between twelve and thirteen millions of dollars; but of late there has been such a revived interest in this branch of mining that the output will be materially enlarged. Many old properties have been reopened, and new ones developed among the quartz mines, and, as stated else-



where, upwards of forty hydraulic mines, which have been for years unproductive, are now being again actively worked, and numerous applications for permits to mine by hydraulic method are pending. This all tends toward an increased output of gold, and as more capital is invested, our annual gold product should be maintained for some years at fifteen to sixteen millions.

The product of silver in California is comparatively small, but the ores of the principal camp, Calico, San Bernardino County, can be worked cheaper than any silver ores on the Pacific Coast, so that some of the principal mines there have continued working, notwithstanding the fact that silver recently declined to the lowest point in value ever reached. This will account for the fact that during 1893, while silver mines all over the country were closing down, California more than doubled the silver output of 1892. The extensive silver belt in Shasta County is only partly developed. More or less silver is found with the gold ores throughout the State, but the entire silver product is now only a little over half a million a year.

The following tables, based on returns to the Director of the United States Mint, show the gold and silver product of California, by counties, for the past two years:

*Gold and Silver Product of California for 1892.*

County.	Gold.	Silver.	Total.
Amador .....	\$1,210,383 45	\$8,007 99	\$1,218,391 44
Butte .....	316,998 50	610 00	317,608 50
Calaveras .....	794,531 31	24,441 32	818,972 63
Del Norte .....	4,102 00	-----	4,102 00
El Dorado .....	198,321 54	-----	198,321 54
Fresno .....	112,981 00	6 00	112,987 00
Humboldt .....	87,515 25	-----	87,515 25
Inyo .....	13,930 31	35,995 34	49,925 65
Kern .....	107,738 92	72 49	107,811 41
Lassen .....	15,400 00	-----	15,400 00
Los Angeles .....	219,204 00	-----	219,204 00
Mariposa .....	81,011 94	67 14	81,079 08
Merced .....	445 96	-----	445 96
Mono .....	396,296 85	70,006 59	466,303 44
Napa .....	795 69	22,893 47	23,689 16
Nevada .....	1,945,406 31	8,325 72	1,953,732 03
Orange .....	9,470 00	-----	9,470 00
Placer .....	1,159,079 60	2,119 74	1,161,199 34
Plumas .....	432,294 62	11,730 84	444,025 46
Sacramento .....	121,900 00	-----	121,900 00
Santa Barbara .....	896 00	-----	896 00
San Bernardino .....	47,037 00	67,072 27	114,109 27
San Diego .....	396,517 98	2,050 75	398,568 73
San Luis Obispo .....	1,097 00	-----	1,097 00
Shasta .....	574,832 88	7,977 29	582,810 17
Sierra .....	688,464 30	26 11	688,490 41
Siskiyou .....	1,013,331 78	56 16	1,013,387 94
Stanislaus .....	14,190 60	-----	14,190 60
Trinity .....	1,466,603 05	168 33	1,466,771 38
Tulare .....	24,355 38	11 28	24,366 66
Tuolumne .....	1,092,549 55	911 63	1,093,461 18
Yuba .....	44,217 80	-----	44,217 80
Totals .....	\$12,571,900 57	\$262,550 46	\$12,834,451 03

*Gold and Silver Product of California for 1893.*

County.	Gold.	Silver.	Total.
Amador .....	\$1,505,973 98	\$5,230 56	\$1,511,204 54
Butte .....	307,350 53	5,503 56	312,854 14
Calaveras .....	1,669,192 95	121 80	1,669,314 75
Colusa .....	300 00	-----	300 00
Del Norte .....	10,352 00	-----	10,352 00
El Dorado .....	294,610 26	1,219 80	295,830 06
Fresno .....	7,118 79	-----	7,118 79
Humboldt .....	66,353 61	-----	66,353 61
Inyo .....	25,944 67	52,474 62	78,419 29
Kern .....	83,665 72	1,754 00	85,419 72
Los Angeles .....	14,200 00	-----	14,200 00
Madera .....	150,696 53	314 24	151,010 77
Mariposa .....	164,116 17	307 00	164,423 17
Mono .....	293,637 39	11,401 11	305,038 50
Nevada .....	2,067,203 22	1,229 27	2,068,432 49
Placer .....	1,351,249 70	616 00	1,351,865 70
Plumas .....	362,488 05	13 50	362,501 55
Riverside .....	42,412 41	-----	42,412 41
Sacramento .....	90,090 57	-----	90,090 57
San Bernardino .....	158,000 00	447,020 00	605,020 00
San Diego .....	105,860 33	-----	105,860 33
San Luis Obispo .....	600 00	-----	600 00
Shasta .....	500,407 01	8,577 26	508,984 27
Sierra .....	830,343 15	45 50	830,388 65
Siskiyou .....	799,108 07	-----	799,108 07
Stanislaus .....	150 00	-----	150 00
Trinity .....	1,122,994 50	-----	1,122,994 50
Tulare .....	12,818 00	-----	12,818 00
Tuolumne .....	354,734 72	1,392 50	356,064 22
Yuba .....	30,839 27	-----	30,839 27
Totals .....	\$12,422,811 60	\$537,157 77	\$12,959,969 37

It is not, however, in gold and silver alone that the mineral wealth of California consists. Many other substances are mined here, which even now bring the value of the mineral products up to about \$19,000,000 or \$20,000,000 per annum: Many of these are increasing in value year by year, as there is more demand and a better market for the product.

With the results for a single year in view, the great importance of the mining industries of California is apparent. As now conducted in the State, mining is not only a profitable but a safe industry, and the variety of products shows that it is a diversified one. Many thousands of men are directly employed and an immense amount of money put in circulation by the operations of our mines, quarries, etc. The mineral industry is one especially deserving the encouragement of the people of California, not only because it continues to be a source of great profit, but because, through it, the settlement of the State was originally brought about.

While only a part of the great number of mines in this State have been visited by our field assistants during the period under review, it is found that those mines, quarries, etc., referred to in this report give direct employment to 13,107 men, and doubtless, indirectly, to as many more. With a complete list of all the mines of the State, and an enumeration of their employés, such as it is the intention to make, this number will be largely increased.

The following statement shows the amount and value of all the mineral products of the State for the year 1893, this being based on direct returns from producers:

*Mineral Products of California in 1893.*

Antimony .....	50 tons .....		\$2,250 00
Asbestos .....	50 tons .....		2,500 00
Asphaltum .....	9,150 tons .....		161,250 00
Bituminous rock .....	32,006 tons .....		192,036 00
Borax .....	7,910,563 pounds .....		593,292 00
Chrome .....	3,319 tons .....		49,785 00
Clays—			
Bricks .....	103,900 M .....	\$801,750 00	
Pottery uses .....	24,856 tons .....	67,284 00	
			869,034 00
Coal .....	72,603 tons .....		167,555 00
Copper .....	239,682 pounds .....		21,571 00
Gold .....			12,422,811 00
Granite .....			531,322 00
Gypsum—			
Plaster of paris .....	180 tons .....	\$3,245 00	
Wall plaster .....	240 tons .....	2,640 00	
Fertilizer .....	1,200 tons .....	8,400 00	
	1,620 tons .....	\$14,280 00	14,280 00
Infusorial earth .....			2,000 00
Iron ore .....	250 tons .....		2,000 00
Lead .....	333 tons .....		24,975 00
Limestone—			
Lime .....		\$288,626 00	
Flux .....		12,650 00	
			301,276 00
Macadam rock .....	271,500 cubic yards .....		256,875 00
Magnesite .....	1,093 tons .....		10,930 00
Manganese .....	270 tons .....		4,050 00
Marble .....			40,000 00
Mineral paints—			
Iron .....	30 tons .....	\$900 00	
Litharge and red lead .....	148 tons .....	17,760 00	
Metallic .....	212 tons .....	4,135 00	
Ocher .....	200 tons .....	4,000 00	
	590 tons .....	\$26,795 00	26,795 00
Mineral waters .....	383,179 gallons .....		190,667 00
Natural gas .....			68,500 00
Onyx .....			27,000 00
Paving blocks (basalt) .....	2,770 M .....		96,950 00
Petroleum .....	470,179 barrels .....		608,092 00
Platinum .....	75 ounces .....		517 00
Quicksilver .....	30,164 flasks .....		1,108,527 00
Rubble rock .....	99,600 tons .....		199,200 00
Salt .....	50,500 tons .....		213,000 00
Sandstone .....			26,314 00
Silver .....			537,157 00
Slate .....	3,000 squares .....		21,000 00
Steatite .....	400 tons .....		17,750 00
Total .....			\$18,806,261 00

Since the preparation of the previous report issued by the Mining Bureau, there has been a marked and gratifying change in the conditions affecting the great hydraulic mining industry of California, some of the mines having again become productive. It is now possible to mine by the hydraulic method, under certain specified restrictions, in any part of the State; whereas, for many years before the passage of the so-called "Caminetti law," only those hydraulic mines tailing into the tributaries of the Klamath were enabled to carry on operations without danger of annoying suits at law. As a result, most of the larger and great numbers of the smaller hydraulic mines on streams



which drain into the Sacramento and San Joaquin rivers, or their tributaries, were closed by injunction, on the plea that the debris resulting from mining by this method was injuring the navigable streams or the farming lands along the banks.

In his inaugural address, in January, 1891, Governor H. H. Markham called the attention of the Legislature and the people of the State to the subject of the possible rehabilitation of the hydraulic mines, and the advantage to be derived by again bringing about an increased gold production from that source. He suggested that the long-pending controversy between the residents of the mountain and valley counties might be amicably adjusted, and that Congress should be memorialized, and our Senators and Congressmen asked to lend their aid in rehabilitating the industry.

In accordance with Governor Markham's suggestion, the Legislature adopted a suitable memorial, which was forwarded to Congress. The miners themselves, with a revived hope, took concerted action, which resulted in a Miners' Convention being held in the city of San Francisco and which was largely attended, not only by delegates from the mountain or mining counties, but from the valley or farming counties as well. An amicable understanding was reached, the miners asking only that Congress should devise some means by which the hydraulic mining properties could be worked without inflicting any of the injuries complained of in the past. A memorial to this effect was sent to Washington. A commission of Government engineers, appointed by Congress, had previously made an investigation of the region affected by the hydraulic mining debris, and reported that under certain conditions impounding dams for the debris could be constructed which would prevent most of the damage resulting from this method of mining.

The Caminetti bill was introduced, and the Legislature of this State, by a joint resolution, asked Congress to pass it or some similar measure, and it was finally passed, March 3, 1894. The essential feature of the new law is that the miners must impound the debris behind works constructed at their own expense, under the supervision of the Government Commission. They must obtain a license to do this, which may be revoked at the pleasure of the Commission, should the dams or other impounding works be found inadequate to protect the rivers.

While, under these limitations, the hydraulic mines cannot be made so productive as under former conditions, when the amount of gravel washed was not restricted, yet many of them which have been idle for years may now be worked, and this number will be gradually increased as new works are constructed. We should therefore see a material increase in our annual gold product from this source.

Under the provisions of this law (which is given in full in an appendix to this report) the President of the United States appointed the following members of the Corps of Engineers, U. S. A., as the California Debris Commission: Col. Geo. H. Mendell, Lieut.-Col. W. H. H. Benyaurd, and Major W. H. Heuer. The office of the Commission is room 92, Flood Building, San Francisco, and the Recorder is Lieut. C. E. Gillette, Corps of Engineers, U. S. A. Since the organization of the Commission, 76 applications for permits to mine by the hydraulic method have been received, and 42 permits issued. The mines operating under these permits (up to September 20, 1894) are as follows:

*Mines to which Permits have been Granted to Mine by the "Hydraulic Method," by the United States Debris Commission.*

Name of Mine.	Near.	County.	Applicant.	Mine Drains into a Tributary of.	Permit Granted.
Badger	T. 3 N., R. 6 W.	Shasta	W. R. Stewart.	Cottonwood	Jan. 2, 1894
Blue Gravel	Smartsville	Yuba	Louis Corvath, Excelsior Mining and Water Company	Yuba	Oct. 17, 1893
Campes	Brownsville	Yuba	Tonsteno Campo	Main Yuba	Mar. 7, 1894
Conduit Ravine	Brownsville	Yuba	W. W. & W. A. Lemon	Yuba	Mar. 27, 1894
Corbiere & Bean	Hampshire Creek	Butte	Corbiere & Bean	North Yuba	Nov. 21, 1893
Crane Brothers	Brownsville	Yuba	Crane Brothers	Yuba	Mar. 7, 1894
Craycroft Hill Placer Mining Co.	Downville	Sierra	Craycroft Mining Company	North Yuba	May 29, 1894
Davis	Down Creek	Sierra	Joseph Davis	North Yuba	Jan. 2, 1894
Eureka Mining Company	Downville	Sierra	Frank R. Wehe, Eureka Mining Company	North Yuba	May 29, 1894
Eureka Hydraulic.	Placerville	El Dorado	Pascos & Gruber	American	April 10, 1894
Excelsior Hydraulic	-----	Sierra	Excelsior Mining Company	North Yuba	May 29, 1894
Farral	Columbia Hill	Nevada	Robert McMurray, Eureka, Lake, and Yuba Canal Company	Middle Yuba	Sept. 8, 1893
54 Flat	Volcano	Amador	J. Nichols, 54 Flat Mining Camp.	Mokelumne	Feb. 9, 1894
First Chance	Howard Creek	Sierra	Frank E. Barberio	North Yuba	Jan. 2, 1894
French Corral	French Corral	Nevada	Kate Hayes Mining Company	South Yuba	Mar. 13, 1894
Gopher Hill	Spanish Ranch	Plumas	W. C. Ralston, Quincy Mining Co.	North Feather	April 14, 1894
Green Meadows	Glencoe	Calaveras	H. B. Havens	Mokelumne	April 17, 1894
Green Mountain	Mokelumne Hill	Calaveras	J. W. Smith	Calaveras	Jan. 8, 1894
Grub Flat	Meadow Valley	Plumas	John Tucker and S. C. Brown	Feather	April 14, 1894
Herring Ravine	Brownsville	Yuba	J. M. Wetmore	Mar. 7, 1894	Mar. 7, 1894
Hustler	Cherokee	Nevada	Joseph Hustler	South Yuba	Aug. 13, 1894
Illinois Gold Gravel	La Porte	Plumas	H. Buckley and Louis Hillman	North Yuba	Jan. 31, 1894
Kelly Hill	T. 23 N., R. 6 E.	Butte	R. M. Mozer	Sacramento	Mar. 27, 1894
Manzanita	Sweetland	Nevada	Kate Hayes Mining Company	Main Yuba	May 1, 1894
Mateos	Howard Creek	Sierra	Manuel Mateos	North Yuba	Jan. 2, 1894
Motor	Brownsville	Yuba	Jas. Gordon	Yuba	Mar. 7, 1894
New York Gold Gravel	T. 21 N., R. 12 E.	Sierra	Westall & Hughes	South Yuba	Dec. 5, 1893
North Star	Mokelumne Hill	Calaveras	H. B. Havens and P. and B. McGuire	Mokelumne	Jan. 10, 1894
Oriental and Tahoe	Randolph Flat	Nevada	James Hackett	Yuba	Aug. 6, 1894
Polar Star	Dutch Flat	Placer	John Spaulding	Bear	Dec. 13, 1893
Pomroy	Ono	Shasta	John McGrew and Alonzo Engle	Cottonwood	Jan. 31, 1894
Red Hill	Ono	Shasta	Nathan Gardner	Sacramento	Feb. 6, 1894
Schuyler	Igo	Shasta	Thomas White	Sacramento	July 23, 1894
Snow Bros.	Newtown	El Dorado	Snow Bros.	American	April 3, 1894

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Spanish Hill Hydraulic	Placerville	El Dorado	El Dorado Water and Deep Gravel Mining Company	American	April 10, 1894
Spanish Hill Gravel	Placerville	El Dorado	Thos. Alderson	American	April 10, 1894
Spring Gulch	San Andreas	Calaveras	J. S. White	Calaveras	Mar. 13, 1894
Stewart Hydraulic	Placerville	El Dorado	John Melton	American	May 1, 1894
Tannery Ravine	Challenge Mill	Yuba	W. R. Reed	Yuba	Jan. 10, 1894
Union	La Porte	Plumas	D. W. Albert	Yuba	Mar. 27, 1894
Walker	Igo	Shasta	Alonzo Engle and Frank Walker	Cottonwood	Jan. 31, 1894
Welch Placer	Carbondale	Sacramento	Columbia Gold Mining Company	Cosumnes	Feb. 18, 1894

During the past two years every county in the State has been visited by one or more of the field assistants, with the single exception of Modoc, where there is no mineral production as far as known.

During 1893 Mr. W. H. Storms visited Amador, Calaveras, Mariposa, Tuolumne, and the northern part of Fresno County; and in addition made an extensive special investigation of the gravel channel system of Calaveras County, the results of which are published in a separate article in this report. In 1894 he visited the counties of Alameda, Contra Costa, part of Los Angeles, Marin, Orange, Riverside, San Bernardino, San Diego, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, and part of Sonoma.

Mr. W. L. Watts in 1893 made a special investigation of the natural gas, asphalt, and petroleum fields of the Central Valley of California and neighboring foothills, the results of which are incorporated in Bulletin No. 3, recently published by the Bureau. While engaged in this he visited all the counties in and bordering upon the San Joaquin and Sacramento valleys. In 1894 he completed the field work commenced the previous year, and visited the counties of Colusa, Fresno, Glenn, Kern, Madera, Merced, Sacramento, San Joaquin, Stanislaus, Tehama, Tulare, and Yolo; and also the oil regions of Los Angeles and Ventura counties and the gold fields of Siskiyou.

In 1893 Mr. E. B. Preston pursued investigations in Butte, El Dorado, Nevada, Placer, and Sierra counties. During 1894 his work was continued in Lassen, Lake, Napa, Plumas, Shasta, Siskiyou, Sutter, Trinity, and Yuba counties.

During 1893 Mr. H. W. Fairbanks, accompanied by Mr. R. P. Heagan, made a careful investigation of the geology and economic mineral features of part of El Dorado County, and of Monterey, San Benito, San Luis Obispo, Santa Barbara, and part of Ventura; and in 1894 the same class of work was continued in Alpine, Inyo, Kern (south of Tehachapi), Mono, and the northwestern portion of San Bernardino. The results of these investigations are published in the special chapters: "Geology of a Section of El Dorado County, embracing portions of Pekin, Agra, Green Valley, Pilot Knob, and Mud Springs Districts"; "Report on the Geology of Northern Ventura, Santa Barbara, San Luis Obispo, Monterey, and San Benito Counties"; and "Preliminary Report on the Mineral Deposits of Alpine, Inyo, and Mono Counties."

In this connection it may be stated that it is to be regretted that the appropriations are insufficient to enable the party engaged in purely geological explorations to camp and study the features of the districts carefully, instead of making what is now necessarily more of a reconnoissance. Much of the region investigated by Messrs. Fairbanks and Heagan is sparsely settled, and unless equipped with a complete camping outfit they are unable to spend the necessary time for study, away from the towns. It would be of immeasurable value to the State could a party be suitably equipped to follow up the work thus commenced, and during the winter pursue the petrographical study of the specimens collected.

Mr. F. C. Mathyas, acting under your special request to look carefully into the coal, iron, and platinum resources, visited, during 1893, nearly all the counties north of Tehachapi, and in 1894 traversed the rugged regions of Del Norte, Humboldt, and Mendocino counties. This report

on the coal fields of the State is of special interest, several new occurrences being described.

Mr. Russell L. Dunn has made a very careful study of the extensive fields of auriferous gravel in Siskiyou County, which are, as yet, but partly developed. The result of this work is printed as a separate chapter of this report under the title "Auriferous Conglomerate in California." Mr. Dunn finds an auriferous deposit there which he considers unique, and which is comprehensively an auriferous gravel bed compacted into a conglomerate. As it requires much the same methods of mining and treatment as the Transvaal (South Africa) conglomerate deposits, the name "auriferous conglomerate" is suggested. The chapter will be read with interest by the gravel miners of the State, and should Mr. Dunn's conclusions be found, through practical operations, to be correct, a new source of gold product will be added to the many varieties already found in California.

The chapter contributed to this report by Mr. Thomas H. Leggett, President and Manager of the Standard Consolidated Mining Company of Bodie, describes not only the electrical power plant at that mine, but several others now in operation. It will be found of great value to the mining community, giving as it does the results of practical experience in generating, transmitting, and applying electricity as a motive power for quartz mining, milling, etc.

In the preparation of this report, the assistants were all instructed to be as concise as possible in their statements. The manuscript was carefully scrutinized, revised, corrected, and condensed, and upon being properly edited was copied in typewriting.

It is to be regretted that in a few instances mine owners and others were indifferent to the objects and labors of the Bureau, and refused to give our field assistants any information concerning their mines or kindred industries. As it is the object of these investigations to ascertain the condition of the mineral industry of the State, with a view to disseminating information for its benefit, it seems strange that any one engaged in mining and the allied industries should refuse to put the Bureau in possession of such *general facts* as are asked for. It is not desired to make public any private business affairs, but simply to ascertain the general condition of the mines, etc.

The Goler and adjoining districts in Kern County have been discovered since the last report was prepared, and many mines are being worked, the production of gold being considerable.

Petroleum has been discovered within the city limits of Los Angeles, and many wells sunk and brought to a producing point. Field work has already been commenced on the study of the formation there by special request of the Los Angeles Chamber of Commerce, and it is hoped that in the course of eight or ten months the Bureau will be in a position to issue a bulletin on this field, and show by maps and text not only the relation of the Los Angeles oil fields to those of Ventura and Kern counties, but determine the formation beyond where oil is likely to be developed.

*Bulletin No. 1* of the State Mining Bureau was published in 1888, being the description of certain "Desiccated Human Remains," in the Bureau museum, by Dr. Winslow Anderson. Three bulletins have been issued by the Mining Bureau during 1894, as follows: *Bulletin No. 2*, on "Methods of Mine Timbering," by W. H. Storms, Assistant in the Field;



*Bulletin No. 3*, "Gas and Petroleum Yielding Formations of the Central Valley of California," by W. L. Watts, Assistant in the Field; *Bulletin No. 4*, "Catalogue of Californian Fossils," by Dr. J. G. Cooper. There are prepared, but not yet printed, two more bulletins, viz.: "The Cyanide Process," by Dr. A. Scheidel, M.E., and "Notes on Gold Milling Practice in California," by E. B. Preston, M.E.

It is the intention of the Bureau to publish each year a "*Mineral Statistics Bulletin*," giving the yield and value of all the mineral products of the State for the preceding year. The addresses of all producers have been or are being obtained with this object in view. The only detailed statistics now available are those obtained by the U. S. Mint and the U. S. Geological Survey, but they are generally published many months after they are collected. The Bureau will endeavor to publish this bulletin as soon after the close of each year as it is possible to get returns from the mines. It will cover the statistics of all mineral substances worked in California.

It is intended also to issue special bulletins on Mine Drainage, Mine Ventilation, Mine Pumps, Methods of Quarrying and Preparing Slate for Market, Electricity for Power for Hoists, Mills, Drills, etc. The bulletins issued thus far in 1894 have met with marked favor, and are in such great demand that already a second edition of that on "Methods of Mine Timbering" is necessary.

It is suggested that it might be well to follow the precedent established by the U. S. Geological Survey, and charge all people *outside of the State* (except public institutions, such as libraries, colleges, etc.) for the publications of the Bureau. The demand for the reports, bulletins, maps, etc., is so great that the item of postage alone is considerable. A small charge for the publications would assist in defraying the expenses of the Bureau. People who do not contribute to the support of the State government can hardly expect its publications free, yet demands are constantly being made for our reports and bulletins from Nevada, Idaho, Utah, Montana, Oregon, and other mining sections, as well as from the Eastern States and foreign countries.

The edition of 10,000 copies of the Xth Report is exhausted, and as it is frequently referred to in this report, descriptions of mines, etc., mentioned therein, will be copied and mailed to those making application for such detailed information.

It is not generally known that packages of minerals not exceeding 20 lbs. in weight, may be sent to this Bureau *free* from any railroad office of Wells, Fargo & Co. within this State. By this means miners may send specimens of their ores for donation or examination; the former being duly classified, appropriately labeled with the names of the donors, and remaining on permanent exhibition in our museum. A special feature of the Bureau is the determination of minerals. This is done free of charge, *but no quantitative analyses nor assays are made*. In order to accommodate those who have confidence only in an official analysis or assay, I would recommend that the Legislature enact a law permitting the Bureau to make *check analyses and assays*. Those who desire them should send the substance to be analyzed to the Bureau, where it would be thoroughly intermixed and three samples taken—one to be kept in the Bureau, one to be analyzed or assayed in the Bureau, and the third to be sent to whatsoever chemist or assayer the party sending the substance may designate. The charge, therefore, should be double



that usually paid here—one half to go to the Bureau and one half to the private chemist or assayer.

The mineral exhibit at the recent Midwinter Fair in this city, arranged by a committee of the California Miners' Association, was in every way creditable. The Mining Bureau contributed seven cases containing every economic mineral found in the State, and I would have recommended that a much larger exhibit be made had we a fund to draw upon for the necessary expenses; but having the largest and finest mineral collection west of the Missouri River, in the very heart of the city, and *free to the public*, the State Board of Examiners would hardly consent to pay the State's money to maintain the State's property in an exhibition where an admission fee was charged under the foregoing conditions. The mine owners and counties of the State sent many and fine specimens of ores and minerals, so that the collection as a whole was well calculated to attract attention to the mining industry of California.

Forming an appendix to this report are the full texts of several laws which have been passed during the period covered by our twelfth report. These are the following:

(1) "An Act to provide for the establishment, maintenance, and support of a bureau, to be known as the State Mining Bureau, and for the appointment and duties of a Board of Trustees, to be known as the Board of Trustees of the State Mining Bureau, who shall have the direction, management, and control of said State Mining Bureau, and to provide for the appointment, duties, and compensation of a State Mineralogist, who shall perform the duties of his office under the control, direction, and supervision of the Board of Trustees of the State Mining Bureau," approved March 23, 1893. This is the new Organic Act under which the State Mining Bureau is now conducted.

(2) "An Act to establish a uniform system of mine-bell signals to be used in all mines operated in the State of California, and for the protection of miners," approved March 8, 1893.

(3) "An Act to amend an Act entitled 'An Act to establish a Civil Code,' approved March 21, 1872, by adding thereto two sections, to be known as Sections 1424 and 1425, being title nine, part four, division two, of said code, concerning the manner of conducting the business of hydraulic mining," approved March 24, 1893.

(4) "An Act to provide for the appointment, duties, and compensation of a Debris Commissioner, and to make an appropriation to be expended under his directions in the discharge of his duties as such Commissioner," approved March 24, 1893. Under the provisions of this Act, Mr. John F. Kidder, of Grass Valley, has been appointed Debris Commissioner.

(5) "An Act to create the California Debris Commission and regulate hydraulic mining in the State of California," approved March 3, 1894. This is the so-called "Caminetti law," reference to which has been previously made.

There is an almost constant demand upon the Bureau for copies of the United States mining laws, and had not this report been already sufficiently voluminous, with a prospect also that at its next session Congress may make important changes, they would have been prepared for publication.

An important mining suit between the Champion and Wyoming mines, Nevada County, has been decided in the United States District

Court, but as it has been appealed, it is deemed best to defer giving an abstract of the decision until the Supreme Court passes upon the questions involved.

I take pleasure in acknowledging the valuable coöperation of Governor H. H. Markham in all matters appertaining to this office. He has always been ready with cheerful advice and assistance, has personally inspected the Bureau and its workings, and shown great interest in its advancement and success.

I desire to express my thanks also to your Board for its hearty coöperation in the work of conducting the business affairs of the Bureau, and assistance in carrying out the various suggestions connected with the general work.

The daily presence and assistance of your President, Mr. J. Z. Davis, is very highly appreciated by the State Mineralogist and all the employés of the Bureau. No man could be more disinterestedly zealous in furthering the advancement of this institution. The active personal interest taken by him in all the details of its administration is of the highest value to the Bureau and the State. His accustomed generosity continues moreover, and the museum has been greatly enriched by his numerous and constantly added donations.

I am gratified to be able to say, also, that each and every one of the field assistants and office employés has displayed ability, diligence, and zeal in his duties, and to each I tender my thanks for their hearty coöperation in the work of the Bureau.

The members of the mining engineering profession, and many other friends of the Bureau throughout the State, deserve the thanks of the Trustees and Mineralogist for assistance rendered in various ways.

Respectfully submitted.

J. J. CRAWFORD,  
State Mineralogist.

## MINES AND MINING PRODUCTS OF CALIFORNIA.

## ANTIMONY.

The only works in the United States for the production of metallic antimony from ores are in San Francisco. The ores are obtained both from California and Nevada, the latter State producing the major portion. The total output of metallic antimony in 1893 was 200 tons, valued at \$36,000. This was from 400 tons of ore, of which the California production was 50 tons of 50 per cent ore.

## INYO COUNTY.

*Panamint Range.*—Deposits of stibnite occur on the western slope of this range, 3 miles S. of Wild Rose Springs. They outcrop along the side of the mountains at an altitude of 5,000 to 6,000 feet. Eleven claims have been located on these veins, which extend E. and W. in a body of mica schist. The dip is S., but at a very small angle. The surface openings show the deposits to vary in thickness from a few inches to 5 ft. Not enough work has yet been done to demonstrate their real extent. In many places the stibnite is quite pure, in others it has with it a gangue of quartz. On some of the claims the oxide of antimony is in excess of the sulphide, and evidently has resulted from the oxidation of the latter. The main vein can be traced for a distance of over 4,000 ft. On the north side of Wild Rose Valley another vein, 18 in. in thickness, has been opened. There are probably 100 tons of ore on the various dumps. J. Danielson, C. Anthony et al., of Darwin, owners.

## KERN COUNTY.

The antimony-bearing formations of Kern County have been worked on Erskine Creek, in the Sierra, and in the San Emidio Mountain, in the Coast Range.

*Boushy Mines.*—They are on Antimony Mountain, near the head of the San Emidio Cañon. See our Xth Report, p. 225. These mines have been worked intermittently since 1890, and ore has been reduced.

*Erskine Creek.*—There are several small mines on this creek which have yielded sulphide of antimony, and, in some of them, native antimony. See our XIth Report, p. 237. A few years ago a furnace was erected for the reduction of antimony ore, but in 1893 it was standing idle.

*Grace Darling Mine.*—This is near Erskine Creek, and was discovered at an early day, but was not worked until 1891. Ten tons of ore were shipped from this mine in 1893.

*Padre Mine.*—It was discovered in 1892. It is situated on the east side of Tail-hold Cañon, which leads into Pleyto Cañon. The lode appears to have the same general strike as that on which the Boushy



mines are situated. The workings consist of a 25 ft. long tunnel, which cuts a body of antimony-bearing matter 15 ft. in width. The wall rock is granitic. In 1893 there were about 3 tons of high-grade antimony ore (stibnite) on the dump. The mine is reached by a rough trail, but a road could be made without great difficulty to the Pleyto Ranch. Hauling from the Pleyto Ranch to Bakersfield costs from \$4 to \$5 per ton.

*Standard Mine.*—This is on the East Fork of Erskine Creek, at the contact of the slate and limestone formations. At this mine a pocket was taken out which yielded about 15 tons of high-grade ore (stibnite), which showed 60 per cent of metallic antimony by assay, and was sold in 1893 for \$45 a ton f. o. b. the cars at Caliente, 40 miles distant. This price was not remunerative.

*San Emidio Mines.*—These mines are located in San Emidio Cañon, in the southern part of Kern County. The veins outcrop on the sides and over the summit of a rugged granite peak rising over 6,000 ft. It is almost perpendicular on its eastern side, where the position and character of the deposits are well shown. The ore appears in places over a vertical distance of 1,000 ft. or more. Where the ore is not found the line of the fissure is marked by a red stain and the decomposed condition of the granite. The deposits have a N.W. course and vertical dip. The ore appears as discontinuous, bunch-like bodies along a fissure system, occasionally reaching a thickness of 10 ft. On the summit of the mountain the ore bodies are not confined to a single fissure, but occur over an area 2,000 ft. wide. The property consists of five patented and four unpatented claims. The ore averages 40 per cent antimony. In places it is rich in silver, with the occasional appearance of iron and arsenical pyrites. A tunnel from the San Emidio Cañon 1,300 ft. long would cut the veins at a depth of 2,000 ft. At present the mines are reached only by a steep and narrow trail, down which all the ore has to be packed to the reduction works. Nothing but assessment work has been done for some time. See our VIIIth and Xth Reports, pp. 680 and 225.

*Undeveloped Deposits.*—In the mountains east of the San Emidio mines are a number of antimony deposits, as yet undeveloped. The deposits are also in granite and have a nearly E. course. The ore is found in places for a distance of 4 miles.

#### SAN BENITO COUNTY.

*Ambrose Mine.*—This mine is in the McLeod District, in the N.E. corner of the county. The ore occurs in the form of a somewhat bunchy vein, varying in width from a mere streak to 2 ft., and is inclosed in quartz trachyte. The walls proper are 5 ft. apart, with crushed trachyte between them. The antimony is found next to the hanging-wall seam and crystallized from that seam. Two tunnels have been run, one 365 ft. long and the other 320 ft. At present an upraise is being made to connect the two. The deposit is remarkable for the beautifully crystallized masses of which it is largely composed. In 1893, 10 tons of ore, which yielded 50 per cent of metallic antimony, were shipped from this mine. See our Xth Report, p. 517. Joseph Bishop, of Hollister, owner.

*Appeal Mine.*—At this mine a body of antimony-bearing silicious rock is exposed, which appears to be an extension of the ledge on which



the Shriver is situated. The owner states that  $1\frac{1}{2}$  tons of high-grade antimony ore (stibnite) were shipped from this mine in 1893.

*Gleason Mine.*—This mine was opened in 1893. It is in Sec. 6, T. 12 S., R. 7 E. A ledge of antimony-bearing silicious rock is here exposed, which has a width of more than 20 ft. The strike of the ledge is about N.  $22^{\circ}$  W. The workings consist of an open cut 20 ft. long and 12 ft. in depth. The owner states that 8 tons of high-grade ore (sulphide of antimony) were shipped from this mine in 1893.

*Shriver's Mines.*—This group of claims is situated in Sec. 31, T. 11 S., R. 7 E., and consists of the Shriver, Eureka, Star, and other claims.

*Shriver Mine.*—It is about 2 miles S.W. of the Ambrose Mine. The deposit occurs in a dark volcanic rock. The dip is  $70^{\circ}$  to the N.E. The vein is irregular, along a crushed zone. See our VIIIth and Xth Reports, pp. 485 and 516. G. Shriver, of Hollister, owner.

*Eureka (Buckeye) Mine.*—The principal workings on this claim are about a quarter of a mile S.E. from the Shriver. They consist of a tunnel about 100 ft. in length, from which short drifts lead off to the N.E. and S.W. The lode is a silicious antimony-bearing rock, similar to that seen in the Shriver.

*Star Mine.*—A ledge of silicious antimony-bearing rock is exposed on this claim. The owner states that he struck a good "prospect" of cinabar while doing assessment work on this claim in 1893.

#### SAN LUIS OBISPO COUNTY.

*San Simeon Creek.*—No work has been done on the antimony deposit on the head of this creek for two years. Several tons of good ore were taken out, and then the work stopped. The deposit appears as a short, bunchy vein in sandstone of apparently Tertiary age. The vein has been opened for a distance of 40 ft., and shows a greatest width of 3 ft., thinning out toward either end. The quantity cannot be great unless it increases with depth. See our Xth Report, p. 579.

#### ARGENTIFEROUS GALENA.

##### INYO COUNTY.

*Baltic Mine.*—This mine is situated on the eastern slope of the mountain range in the northern part of the county. It has been worked much of the time for the past fifteen years. The vein is said to average 3 ft. wide. At present nothing is being done. L. P. Roberts, of Big Pine, owner.

*Belmont Mines.*—These are situated near the summit of the Inyo range, 3 miles S.E. of Cerro Gordo. Nothing has been done here recently, and the properties are for the most part abandoned. They were thoroughly described by Mr. Goodyear in our VIIIth Report, p. 252. W. S. Hunter, of Independence, owner.

*Black Warrior, Fitz, and Antelope Mines.*—These mines are situated on Lookout Hill, and belong to the same group of mines as those of the Modock Mining Company. They are developed by both tunnels and shafts. About 30 per cent of the value of the product of these mines is lead and 5 per cent gold. Frank Fitzgerald, of Modock, owner.

*Defiance, Independence, Burnon, and other Mines.*—These mines are situated 1 mile N. of Darwin, on Mt. Ophir. The Defiance is the most noted of this group and has been worked for many years. The Burnon and Independence have been idle for the past year. The ore is silver-bearing galena in the form of chamber deposits in a calciferous quartzite, which quartzite lies between limestone and a granitic rock. A rich body of ore has recently been struck in the Defiance. These mines were described in our VIIIth and Xth Reports, pp. 226 and 211. P. Reddy, Crocker Building, San Francisco, owner.

*Lucky Jim and Christmas Gift Mines.*—They are 3 miles N. of Darwin, on a continuation of the same mineral belt on which the Defiance Mine is situated. The Lucky Jim is now being reopened and the material left in the old stopes sorted and jigged. The ore is a silver-bearing galena. The mine was described in our VIIIth and Xth Reports, pp. 226 and 211. J. A. McKenzie, of Darwin, owner.

*Modock Consolidated Mining Company's Mines.*—They are as follows: Confidence, Lookout, Modock, Keys, and Hearst. They are situated on the eastern slope of the Argus range, 15 miles S.E. of Darwin. At present they are being worked under a lease. The deposits are chiefly silver-bearing galena with a little gold, the inclosing rock being limestone. The deposits are generally in chamber form, though sometimes approximating the form of veins. A tunnel 1,950 ft. long has been run to tap the deposits, the greatest depth reached below the surface being 1,150 ft. The best ore has been taken from this tunnel. It is said the ore carries 101 to 293 ozs. silver, 52 per cent lead, and less than  $\frac{1}{2}$  oz. gold per ton. Hornsilver and carbonates occur in limited extent. Lookout Hill, on which the mines are situated, seems fairly filled with chamber-like deposits of galena; many not showing on the surface. These mines were located in 1875, since which time it is said \$1,900,000 has been taken out. Frank Fitzgerald, of Modock, lessee.

*Sorba Mine.*—It is 2 miles E. of Darwin. The vein runs E. and W., and is inclosed in limestone, and was discovered in the early days of mining in this section, but the present systematic development dates from the last few months. Three shafts, respectively, 30, 80, and 250 ft., have been sunk. The latter follows the ore body on the incline. The ore consists of galena, carrying silver, hornsilver, carbonates, and a decomposed ferruginous matter containing gold. The ore carries 90 to 200 ozs. silver, 36 to 60 per cent lead, \$3 to \$18 gold per ton. On the surface the vein dips northerly; in the bottom of the incline, easterly. The vein is traceable on the surface nearly the whole length of the claim. Its position bears no relation to the dip and strike of the country rock. Inyo Mining and Development Company, of Darwin, owners.

*St. John and St. Arthur Mines.*—They are situated on the S. side of Lookout Hill, in the section formerly known as the Minnietta. They lie 1,000 ft. lower than the mines of the Modock Consolidated Mining Company. The deposits are a continuation of those of that company, and are of the same character. The side of the mountain is very steep, and the developments consist almost wholly of tunnels. J. J. Gunn, of Modock, owner.

*Union Mines.*—They are near Cerro Gordo, and not far from the summit of the Inyo range, and are at present being worked under a lease. No underground work is going on; all that is being done consists in "sorting" and working over the old dumps. Described in our

VIIIth and Xth Reports, pp. 250 and 213. No new developments have been made since these reports. Thomas Boland, of Keeler, owner.

#### LOS ANGELES COUNTY.

Several veins of argentiferous lead ores are found on Santa Catalina Island, which have been worked from time to time since 1859. During 1893, mines near the isthmus yielded 30 tons of selected ore, which returned, at the Selby Smelting Works, over \$100 per ton. The ore is usually high grade, but occurs in small shoots, and as no systematic development has ever been undertaken, the output has never been large.

Argentiferous lead ores occur on the south slope of the Sierra Madre range, 8 miles N. of Pasadena, in small quantity. Only superficial work has been expended upon them.

#### ORANGE COUNTY.

At several points between *Trabuco* and *Santiago* cañons, considerable prospecting has been done for lead and silver ores. The formation in which these ores occur is a heavily mineralized rock, which in its alteration and general appearance resembles felsite, or rhyolite. Decomposition has progressed so far that it is impossible to more than guess the original character of the rock. The sulphides of lead, zinc, and iron, with gold and silver, have infiltrated the fissures and formed accumulated veins. The baseness of these ores and the low price of silver render the mines almost valueless. These mines are similar to the Old Dominion Mine, in this county. Considerable money and work have been expended on the *Silverado Group*, but all of these properties are now idle.

*Acme Mine.*—This location is 7 miles W. of Elsinore, and adjoins the Old Dominion. The developments consist of an open cut on the vein, and a tunnel 100 ft. below the croppings, which had not yet, to all appearances, cut the vein. This region is full of mineral and justifies intelligent prospecting.

*Old Dominion Mine.*—It is 7 miles W. from Elsinore. The workings consist of several surface cuts, a shaft connected with a cross-cut tunnel, and some small stopes. The strike of the fissures is N.W. and the dip W. The surface ores are oxidized, but soon give way to a mass of intimately mixed, fine-grained sulphides of lead, iron, copper, and zinc. All these ores contain gold and silver, and in some places the grade is quite high. It would appear that by far the most practical way to handle ores of this grade and class would be to sack and ship them to the smelting works. The total cost of mining, transportation, and reduction should be less than the reported yield, and a profit should result.

#### SAN BERNARDINO COUNTY.

There are numerous veins and deposits of argentiferous lead ores (galena and carbonate) in the Silver Mountain District, which comprises that section lying E. and N.E. of Oro Grande, on the Mojave River. These deposits are scattered promiscuously over an area of 6 miles square. The deposits occur in limestone, or at contact of limestone and eruptive rocks, dikes, and intruded masses, which are numerous in the region. The geology is rather complex, owing to the folding and faulting



of the rocks, and the intrusion of the eruptive masses of the many mining locations in this district, some showing encouraging prospects. The following are the most prominent:

*Carbonate Mine.*—This is the largest mine in the district. See our XIth Report, p. 361. Since that report the shaft has been sunk 50 ft. additional, and a winze 30 ft. on the 150 ft. level. A large amount of ore is exposed in these workings, and indications are that the mine will make a good record of production as soon as a market for the ore is opened. The ore contains from 10 to 50 per cent lead, considerable iron and manganese oxide, lime, silica, gold, and silver, and is a very desirable ore for smelters. In the west or Gold shaft, some developments have been made, and the gold seam persistently followed, as small pockets of rich gold rock are occasionally found. Cross-cutting would perhaps result in the discovery of other veins, particularly on the foot-wall side.

*Galoot Mine.*—This claim is 5 miles E. of Oro Grande. It shows a shoot of lead and copper ore 200 ft. long. Several prospect holes on the vein have exposed some high-grade lead ore. It is one of the most promising claims of the district.

*Harrison Mine.*—It is 6 miles E. of Oro Grande. The vein varies from a few inches to 2 ft. of lead and zinc blende. The oxidized ore is said to contain upwards of \$100 in gold per ton.

*Galena, Lookout, Northern Cross, Santa Fe, and Unfortunate Sam Mines.*—Each of these small claims shows small veins or bunches of lead ore. On some of them considerable work has been done, but the result is not encouraging.

The claims at *Galena Camp, North Camp, and West Camp*, 12 miles W. and N.W. of Oro Grande, show more or less lead and silver ore in small bunches; none are working at present.

## ASPHALTUM AND BITUMINOUS ROCK.

California is the principal producer of asphaltum and allied bitumens in the United States. Deposits of asphalt of all the varieties are widely scattered over the United States, but are only worked to any extent in California, Utah, and Kentucky. Two deposits of rock asphalt are worked in this State: one in Kern and the other in Santa Barbara County. There is also one of "liquid asphalt" in the latter county, and in Kern County are numerous superficial deposits of asphaltum. Bituminous rock deposits are found and worked in many counties of California, and some years the product has reached 60,000 tons. Its use as a paving material is constantly on the increase, the bulk of the product coming from the counties of Santa Barbara, Santa Cruz, and San Luis Obispo.

### KERN COUNTY.

The principal asphaltum-bearing formations are in the foothills of the Coast Range, on the western side of the San Joaquin Valley, and in localities known, respectively, as the *Buena Vista District* and the *Sunset Oil District*.

*Buena Vista Oil and Asphaltum District.*—The principal production of asphaltum in Kern County is in this district, which is distant about



30 miles N.W from the Sunset Oil District. The asphaltum industry in Kern County has been greatly stimulated by the extension of a branch line of the S. P. R. R. from Bakersfield to Asphalto, where a refinery, which is furnished with twenty-one kettles, has been erected by the Standard Asphalt Company to work its own claims and lands leased from the Buena Vista Oil Company and others.

The asphaltum deposits at Asphalto are found under two conditions: First, as superficial beds of impure asphaltum similar to those found in the Sunset Oil District. Secondly, as veins of high-grade asphaltum in the country rock. Of these deposits the veins of asphaltum are the most important, for although the superficial beds contain a large amount of crude asphaltum, only a small portion of it is sufficiently pure to pay for mining and refining by the methods now employed.

The asphaltum occurs in deposits with the same strike and dip as the inclosing rock, as well as in fissures that cross the course of the country rock, which appears to be of late Tertiary formation.

The refinery at Asphalto was completed March 1, 1893. The first run was made on 300 tons of crude asphaltum from the superficial asphaltum beds before described. In this run about 100 tons of refined asphaltum were produced. During 1893 the market price for refined asphaltum has averaged \$25 a ton f. o. b. at Asphalto.

In the following table analyses (made by G. O. Simmons, of Sedalia, Mo.) of asphaltum from the Trinidad Pitch Lake are compared with analyses (made by Clifford Richardson, of Washington, D. C.) of asphaltum from the Buena Vista District, California:

	California. Sample H, From Mine.	California. Sample H, Refined.	Pitch Lake— Average.	Pitch Lake— Best.
Specific gravity .....	1.132	1.240	1.3857	1.3771
Softening temperature, Fahr. ....	180 degrees.	150 degrees.	190 degrees.	183 degrees.
Flowing.....	220 degrees.	180 degrees.	205 degrees.	198 degrees.
Inorganic matter .....	9.57 per ct.	9.77 per ct.	35.66 per ct.	35.48 per ct.
Bitumen soluble in CS <sub>2</sub> .....	85.49 per ct.	90.16 per ct.	56.29 per ct.	57.47 per ct.
Bitumen soluble in ether.....	69.98 per ct.	86.45 per ct.	41.43 per ct.	41.59 per ct.
Percentage of total bitumen soluble in ether .....	81.85 per ct.	95.88 per ct.	73.60 per ct.	72.37 per ct.

The following tests of asphaltum were made by H. Stillman, Engineer of Tests to Motive Power and Machine Company at Sacramento (S. P. Co.):

Locality.	Ash.	Soluble.	Insoluble.
Trinidad .....	1.5 per ct.	46.30 per ct.	52.20 per ct.
Cuban .....	2.8 per ct.	44.25 per ct.	52.85 per ct.
Asphalto .....	6.5 per ct.	59.55 per ct.	33.95 per ct.

#### Combustion Tests.

Locality.	Volatile Hydrocarbon.	Fixed Carbon.	Ash.
Trinidad .....	75.15 per ct.	22.7 per ct.	0.15 per ct.
Cuban .....	70.20 per ct.	27.0 per ct.	2.80 per ct.
Asphalto .....	81.40 per ct.	12.1 per ct.	6.50 per ct.

Two samples of asphaltum from Asphalto were examined by W. B. Potter (of the St. Louis Sampling and Testing Works), and yielded 88.9 per cent from No. 1, and 85.32 per cent from No. 2.

Mr. W. E. Youle, manager of the Standard Asphalt Company, states that the crude material, as it is mined from the veins now being worked at Asphalto, averages 75 per cent of asphaltum.

*Buena Vista Oil Company.*—The property of this company consists of about 720 acres in addition to the territory leased from them by the Standard Asphalt Company. On their land are extensive superficial beds of impure asphaltum, and what appear to be outcropping veins of asphaltum have been found.

*Sunset District.*—Asphaltum is found in superficial beds: these beds appear to have been formed by the exudation of heavy petroleum, which, by partial oxidation and the evaporation of its most volatile constituents, becomes a pitch-like bitumen, varying from solid to viscous at ordinary temperatures. During 1892 this crude asphaltum was refined in works established by Messrs. Jewett & Blodget, at the Sunset Oil District, and about 1,200 tons of refined asphaltum were produced and shipped. The cost of producing refined asphaltum at the Sunset works was about \$10 a ton, not including wear and tear of plant. The cost of transportation by wagon from the Sunset Oil Wells to Bakersfield was \$6 a ton. The best quality of raw material in these asphaltum beds has been worked up, and the refining of crude asphaltum was discontinued at the Sunset Oil District when the S. P. R. R. extended its branch line to Asphalto, where there are deposits of asphaltum nearer to the railroad.

More details concerning the occurrence of asphaltum in this county will be found in Bulletin No. 3 of this Bureau, on "The Gas and Petroleum Yielding Formations of the Central Valley of California."

#### SANTA CRUZ COUNTY.

*Baldwin Mine.*—This is on the Baldwin ranch, 95 miles from Santa Cruz in a N.W. direction. During 1893, it produced 1,500 tons of bituminous rock. The rock taken from this mine is soft, and is said to contain 14 per cent of bitumen. Three men were employed in the mine and five in hauling the product.

*Cowell Mine.*—This is half a mile E. of the Walrath, and consists of 40 acres, having 20 ft. of bituminous rock in two strata similar to the Walrath. All of the mines of this group produce both hard and soft rock. The bituminous deposits appear to extend over a considerable area not opened at all. This area is not less than 8 square miles in extent, though probably not more than 3 square miles remain of the original strata, the balance having been eroded. Of that which remains a large amount—in fact, the greater portion—is commercially valueless, because of its low percentage in bitumen, but there are immense quantities of good material which will in time be mined. The usual method of mining is to bore holes 10 to 20 ft. in depth in series extending for some distance along the face. Two or three sticks of giant powder No. 2 are exploded in the bottom of each of these holes with water tamping. Into the chambers thus created large quantities of black powder and some giant are poured. The blasts are fired simultaneously by elec-

tricity. It is a common occurrence to break 500 tons at a single series of shots.

*Enright Mine.*—This is on the Enright ranch, 9 miles up the coast from Santa Cruz. During 1893 it produced 5,000 tons of bituminous sandrock, employing 5 men at the mine and 7 to 12 men in teaming. The mine was not in operation in March, 1894, but expected to be during the summer months. The rock from this mine is hard and contains 16 per cent bitumen. The strata in which the bitumen is found underlie 600 acres, but as far as developed only a portion of this is valuable, though more or less bitumen occurs in this region, covering several square miles. These deposits are exposed in the sides of the numerous cañons and ravines which have been eroded through the soft sediments. The rock of the several quarries has different densities, ranging from 14 to 22 cu. ft. to the ton, the average being about 15 cu. ft. In the Enright deposit fragments of large bones of an extinct animal, presumably mammoth, have been found from time to time. They are found saturated with bitumen. Vein-like masses of bitumen are not uncommon in these deposits. The veins occur in the form of accumulated or segregated deposits. Movements of the earth crust have resulted in fracturing the sandstones in which the bitumen occurs, and in some instances also the strata both above and below the deposits. Into these crevices the bituminous matter has oozed or distilled, forming veins of nearly pure bitumen. It is these occurrences which have given the impression that the bituminous matter came up from below. On the ranch close to the beach an oily matter is oozing from the rocks. A bore-hole was sunk on the plateau or marine terrace on the Sacroni place for oil, but none was developed.

*Thurber Mine.*—The mine lies immediately N. of and adjoining the Walrath, and employs 10 men in the mine and 20 teaming, etc.

*Walrath Mines.*—These are the largest operating in this county at present, though there are more extensive deposits adjacent. The Walrath group consists of 500 acres of land, of which about 75 acres is underlaid by the bituminous strata, of which there are two—the upper 15, and the lower 10 ft. in thickness. The average thickness of both is about 20 feet. The two layers are separated by a stratum of sandstone 8 to 10 ft. thick, which also contains bitumen, but in too small quantity to be valuable. If the deposits maintain their present thickness throughout, the output will be enormous. The mine employs 20 men in the mine and about 50 more in teaming.

#### MONTEREY COUNTY.

*Undeveloped Deposits.*—Bituminous rock occurs on the San Antonio River, 7 miles S.W. of Bradley Station. The deposit is quite extensive, but no work has been done on it. See our VIIth Report, p. 85.

A bituminous rock deposit, 11 miles E. of Kings City, was described in our XIth Report, p. 259.

#### SAN LUIS OBISPO COUNTY.

*Bituminous Rock on the Pismo Grant.*—See our Xth report, p. 574. No recent developments.

*Jordan Mine.*—This is situated in the Corral de Piedra, 7 miles S.E. of San Luis Obispo. The company owning this property has begun



shipping rock from a deposit north of the road leading from San Luis Obispo to Arroyo Grande. At the time of our visit (July, 1893) it was being crushed, sacked, and hauled to the new Pismo wharf.

*Oregon Company's Mine.*—This was formerly known as the California Bituminous Rock Company's Mine, and the deposit was described in our VIIth and Xth Reports, pp. 98 and 574. Here is an immense body of bituminous sandrock exposed in high and precipitous cliffs facing the N.E. The ore croppings are exposed for half a mile and have a thickness of 90 ft. in places. No work was being done at the time of our visit. The deposit is on the Corral de Piedra grant, 7 miles S.E. of San Luis Obispo. Oregon Bituminous Rock Company, of Portland, Or., owners.

*San Luis Obispo Company's Mine* is in the Corral de Piedra grant, 7 miles S.E. of San Luis Obispo. At the time of our visit no work was going on, owing to the small demand for paving material. See our VIIth and Xth Reports, pp. 97 and 572.

*Suey Creek.*—A small deposit of asphaltum or brea is found on Suey Creek, 7 miles from Santa Maria. It is in the form of shallow seepages from the bituminous slate series, which has been much disturbed.

*Tar Springs Asphalt Mine.*—It is on Tar Spring Creek, 9 miles E. of the town of Arroyo Grande. Here numerous tar springs issue from the underlying bituminous slate series. They cover about 10 acres, much of which it is profitable to work. Some of the springs are very large and many barrels of pure tar have been taken from them. The tar is nearly 10 feet deep in places. The greater part of the material is mixed with rocks and soil, and is melted in huge vats from which the pure product is drawn off. Some solid asphaltum of excellent quality has been taken out. Tar together with water is constantly running into the holes which have been dug. Of the refined tar 800 barrels have been shipped. Tar Springs Asphalt Company, owners; C. F. Hunter, 111 South Broadway, Los Angeles, Secretary.

#### SANTA BARBARA COUNTY.

*Gaviota Landing.*—A deposit of bituminous rock occurs here exposed in the high cliffs. The formation is the bituminous slate series, which dips S. at a high angle. There is evidently a considerable body here, but the quality is rather poor. It occurs impregnating irregularly a sandstone stratum inclosed in the shales, and extends out underneath the ocean.

*Harris Asphalt Mining Company.*—This deposit is  $4\frac{1}{2}$  miles N. of Harris Station, on the Los Alamos grant. An excellent quality of asphaltum occurs here, being about 50 per cent. It is of sufficient hardness to break with a conchoidal fracture. The mine is developed by surface workings, which have uncovered a large body of material. It is overlaid by sand, while underneath is a bed of clay. There is no regular deposit; simply large bunches more or less connected. Hewitt & Haskins, of Oakland, owners.

About half a mile W. of the Harris Mine is a body of bituminous rock. A soft horizontally-bedded sandstone has been impregnated with bitumen. The beds outcrop over a considerable area, but never have been opened.

*La Patera Mine.*—This claim is on the Den ranch, near the ocean, 10 miles W. of Santa Barbara. The property was developed first by an



open cut following the course of the deposit, which is N.E. and S.W. The walls are formed of but slightly solidified clays, the stratification of which is very indistinct. In the cut the deposit is seen to consist of buncy veins lying along an irregular fissure, from which stringers extend out into the country rock in various directions. This is one of the purest deposits of asphaltum examined, being 65 per cent bitumen. Four shafts have been sunk, being respectively 60, 65, 70, and 100 ft. deep, showing the asphaltum to be 3 to 12 ft. thick. Much heat is developed as the clay is exposed, so that the asphaltum partly liquefies and runs down the shaft in great masses. In one drift 27 ft. of asphaltum has been taken out, due to the swelling both from top and bottom. Other deposits appear along the ocean both E. and W. of the mine, and much is probably covered by the ocean. The asphaltum in all the deposits from Punta Gorda to and beyond the La Patera Mine has come from the same geological horizon. California Petroleum and Asphalt Company, owners; W. N. Cowles, President, Crocker Building, San Francisco.

*Las Conchas Mine.*—This is on the shore of the ocean near Carpenteria. The liquid tar found here has impregnated a clean beach sand of Quaternary age, overlying the bituminous shales and sandstones of the Miocene. It extends nearly half a mile along the beach, where the bitumen may be seen oozing out of the underlying rocks. The latter strike nearly E. and W., dipping at a high angle. At the point where most of the tar oozes out they are crushed and broken in a remarkable degree. This old beach deposit dips inland slightly, and near the bottom, especially toward the S., where the elevation is greater, large pebbles are mixed with the sand. There is evidently a basin-like depression extending east from Carpenteria partly inland, and the bituminous sands represent the southern and eastern borders. At some distance from the present shore the stratum of sand is nearly level. It extends at least three fourths of a mile inland, where it is often covered by 30 to 50 ft. of sand and soil. The company is working on land between the railroad and the ocean, but bitumen also crops out or oozes to the surface on many other parts of the ranch N. of the railroad. Near Mr. Higgins' house a drill struck the bituminous sand at 30 ft., and passed through it for 30 ft. The sand averages about 20 per cent asphaltum. The thickness of the beds where opened is 20 ft. One cavity was found 12 ft. in diameter, filled with pure liquid asphaltum. Near the ocean the covering of barren sand to be stripped is often less than 12 ft. This is the most remarkable deposit of its kind on the coast, the sand being so pure that it is separated from the asphaltum by the gravity process. The machine was invented for the particular kind of rock found here, and is said to work well; the refined product of liquid asphaltum contains 95 per cent of bitumen. At present none of the crude bituminous rock is shipped. The deposit is apparently inexhaustible and one of the most important in the State. This deposit was briefly described in our VIIth Report, p. 89. California Petroleum and Asphalt Company, owners; W. N. Cowles, President, Crocker Building, San Francisco.

*Purissima Ranch.*—About 2 miles N.E. of the old mission there are several deposits of asphaltum. On one a tunnel has been run, cutting a vein of unknown extent. These are on the same range as the deposits on the Rancho San Carlos de Jonata.

*San Carlos de Jonata Ranch.*—Large beds of asphaltum and bituminous rock occur on this ranch. The most important of these are in the center of the ranch. Two appear in vein form, 40 ft. thick, dipping into a hill from opposite directions, while the third forms a low knoll 300 ft. in diameter. All these deposits are dark in character and apparently of good quality. One of the vein-like deposits has been opened and a small amount shipped. The formation has the usual character of the Miocene in this section, consisting of chalky and banded shales. On the hill and in near conjunction with two of the deposits is another burnt chimney showing red colors and slag-like products. Portions of this rock are silicified, and contain in the cavities small masses of pure bitumen.

*Santa Maria Mines.*—The mines of the Santa Maria Asphalt Company are in the Pine Grove District, 10 miles S.E. of Santa Maria. Asphaltum and bituminous rock both occur here. The asphaltum is reported to be from 46 to 70 per cent. It outcrops over a considerable area along the N. slope of the hills bordering the Santa Maria Valley. The formation is a soft, sandy clay, probably of Pliocene age. The whole hillside seems to be cut up by irregular veins of asphaltum, varying in size from mere stringers to several feet in thickness. The developments are mainly in the form of open cuts. One tunnel has been run 40 ft., all the distance being through asphaltum. Masses 25 ft. across and of unknown length also occur. The deposit of bituminous sandrock belonging to this company lies to the W. of the asphaltum. It occurs covering an area one third of a mile long by 350 ft. wide. The deposit has never been opened, but is apparently very extensive. It shows a depth of 200 ft. as exposed on the side of the hill. Santa Maria Asphalt Company, of Santa Barbara, owners.

*Tar and Tar Springs.*—Tar is found seeping out of the bituminous slate series in the cañon of the Sisquoc, about in the center of the Sisquoc grant. The largest deposits are, however, to be seen along La Brea Creek, a tributary of the Sisquoc on the N. and emptying opposite the ranch house. At the mouth of this creek are heavy beds forming cliffs of a soft, friable sandrock thoroughly impregnated with bitumen over a considerable extent. It is so dried out on the surface that the quality could not be ascertained. For a distance of 2 miles up the creek there are many tar springs, both on the main creek and on its tributaries. The rock from which it exudes is a banded, silicious argillite, weathering light-colored. The dip is to the N.E. at varying angles. Deposits of apparently commercial value appear in several places. The tar is quite thick, and is generally accompanied by water more or less mineralized.

A deposit of thick tar appears in a cañon on the western end of the Tinaquaic grant and about a mile north of the road. The formation is a hard, light-colored slate, belonging to the Miocene. The tar oozes up through the debris in the bottom of the cañon, firmly cementing it in a solid mass. It appears on the surface for several hundred feet. A number of trenches have been dug showing the tar to be so mixed with the coarse rock material that it would be difficult to mine it profitably. Springs of considerable size issue from the trenches and are strongly mineralized.

*Other Deposits.*—Extensive asphaltum deposits occur in the range of hills lying between the Los Alamos and the Santa Ynez River. On the southern slope a vein-like deposit can be traced for miles in a direction

a little N. of W. They are in Sec. 17, T. 7 N., R. 32 E., in the quarter adjoining on the N.E. The highest and most prominent croppings have an elevation of 800 feet above those in the cañon, which seem to belong to the same vein. The deposit has a vertical position in argillaceous rocks, which are but slightly hardened and contain over 40 per cent of bitumen. The asphaltum is so hard that it softens but slightly in the sun. It has been opened by a cut and by a large, deep excavation, from which a few hundred tons have been shipped. The amount of material here is, from all that can be learned, apparently very great, and must become valuable when facilities for shipping are better.

The highest portion of the hills north of the asphaltum beds is formed of a hard, silicious rock, varying from different tints of yellow to bright red in color and often scoriaceous. The center of one of the occurrences, where the metamorphism has been greatest, has been opened by a shaft in search of quicksilver. The rock is porcelain-like in character, and gives a ringing sound when struck. These areas shade off on every side into the soft Tertiary rocks. The porous portions appear in the center of the greatest metamorphism, and closely resemble furnace slag, or a bituminous rock out of which the bitumen has been burned. Whether the intense heat which caused these effects preceded the deposit of the asphaltum, and was the cause of its formation, or occurred later, is not certain. It is certain, however, that they bear some relation to the asphaltum, for in quite a number of places in the county both were found together. There is no eruptive rock here as was supposed by Antisell, one of the geologists of the Pacific Railroad Survey.

*Unopened Deposits.*—At Point Arguello, near the mouth of the Arroyo Honda, and at other points toward Lompoc Landing, are deposits of bituminous matter of unknown value, never having been opened. These are interbedded in the bituminous shales at Point Arguello, while at the mouth of the Arroyo Honda they are associated with soft clays.

#### VENTURA COUNTY.

*Punta Gorda Mine.*—It is situated at Punta Gorda, in the extreme western part of the county. Work has been commenced in a cañon just above the railroad. The bituminous shales and clays strike about E. and W., dipping to the N. at a high angle. The asphaltum occurs in the form of bunch-like veins, well defined but very irregular. It has evidently been squeezed into an irregular fissure, which was formed without any reference to the stratification of the country rock. The veins, as far as developed, vary in thickness from a few inches to 4 ft. A tunnel had been run in 125 ft., and a shaft sunk at the end to a depth of 65 ft. The material taken out carries about 35 per cent bitumen. Punta Gorda Asphalt Mining and Paving Company, of Santa Barbara, owners.

*Undeveloped Deposits.*—An asphaltum deposit has recently been discovered on the western slope of the Rincon, about 2 miles from the Punta Gorda Mine. It is  $1\frac{1}{2}$  miles from the ocean, and has an elevation of 1,200 ft. It occurs impregnating a loose and crumbling sandrock and sandy clays of Miocene age. No developments had been made at the time of the visit, but the quantity exposed is considerable. A road is being graded so as to make it accessible.



## BORAX.

Borax is produced in only two States of the Union—California and Nevada. Extensive deposits are found within the borders of these States which have been worked since 1873. For some years the bulk of the supply was from the Nevada side of the line, but for the past three years California has produced much the larger proportion. In 1892, out of the total yield of 12,538,196 pounds, the California yield was 11,050,495 pounds. In 1893, of a total of 8,699,000 pounds, California produced 7,499,562 pounds. The yield has been reduced of late, owing to decreased demand, which may be attributed to the prevailing depression in all branches of industry. Most of the product is obtained from the "borax marshes"; but in one instance, at Calico, San Bernardino County, where the borate bed has been tilted up with the inclosing sedimentaries, it is mined as a "vein" by means of shafts.

## INYO COUNTY.

*Salt Wells Borax Company.*—The borax deposits of this company are situated in Salt Wells Valley, in the extreme southern portion of Inyo County. About 1,700 acres of borax land has been taken up. This is a recently organized company, and work is just being commenced. The deposits consist of borates of lime and soda. Salt Wells Borax Company, of Independence, owners.

## LAKE COUNTY.

*Borax Lake.*—The extensive plant erected here has been idle for a number of years.

Another locality where borax has been found is at *Little Borax Lake*, near the shores of Clear Lake.

## SAN BERNARDINO COUNTY.

The borax industry in the Calico region has received an impetus within the past two years, by the discovery of new deposits 6 miles N.E. of Daggett, of an entirely different nature from those of the Pacific Coast Borax Company. The new deposits are in the sedimentary strata which lie along the southern flanks of the Calico range at its eastern end. The intrusion of the eruptive rocks has folded, crushed, and displaced these sedimentary beds in a most perplexing manner. It is in the numerous cañons and gulches intersecting these upturned beds that the borate deposits are found. The new field extends from the immediate vicinity of Calico eastward a distance of 5 miles. These deposits present much the appearance of stratified masses of indurated mud; red, green, and gray in color. A white efflorescence occurs in places, giving the rocks a mottled appearance. Some of the rock is bluish-black, and resembles fine-grained, blue limestone. These beds have a generally southerly dip under the desert plain.

Since the above discovery other deposits of similar character have been found 5 miles N.W. of Daggett, on the opposite side of the (Calico) valley. These beds have a northerly dip. This fact suggests the possibility that these deposits are on the same strata. Should this be proven





Searles' Borax Works, Inyo County.



Searles' Borax Team.



to be a fact, the borate deposits will be found to underlie 60 square miles of territory.

These sedimentary deposits do not appear at the western end of the Calico range, and the probability is that if they ever existed at all, they lie buried beneath the later accumulation of debris from the adjacent hills.

*Pacific Coast Borax Company's Mine* is 5 miles E. of Calico. The deposit is described in our III<sup>d</sup>, IV<sup>th</sup>, IX<sup>th</sup>, and XI<sup>th</sup> Reports, pp. 28, 91, 225, and 345. Since then the developments have been extensive and carried on over a considerable area, though chiefly confined to the same vein-like mass. These workings have now extended eastward a distance of 2 miles. The operations of this company are confined almost exclusively to the mining of "colemanite."

*Stevens & Greer Mines* are located along the southern side of the range at various points for a distance of 5 miles. The development on these various claims is small, consisting of open cuts and short drifts. The deposit in Garfield Cañon is exposed 40 ft. wide and 1,000 ft. long. The deposits farther east are quite irregular, much disturbed, and often folded in a synclinal fold, though these basins are found covering an acre or more of territory. The owners of these deposits have manufactured considerable quantities of borax and boracic acid. They pulverize the borate material and carefully add it to a boiling solution of sodium sulphate until brisk effervescence ceases, when the compound solution is allowed to cool and settle; the liquor is drawn off and the borax crystallized on wires by evaporation. An experiment was also made with the "mud-like" borate material. It was subjected to a low heat and then treated with sulphuric acid, which, uniting with the calcium, formed calcium sulphate, liberating the boracic acid; this being soluble, is dissolved out with water and crystallized from the solution by evaporation.

*The Owens Mines* are 5 miles N.W. of Daggett. They occur in sedimentary beds similar to those on the S. side of the Calico range, and have been exposed by the uplift of a mass of eruptive rock, the axis of which is nearly parallel with the Calico range. There is reason to believe that the upturned edges of this formation can be found in many places other than have thus far been discovered. A shaft has been sunk to a depth of 200 feet, vertically, cutting the strata at an angle of 70°. The deposit appears to be not less than 40 or 50 feet in thickness.

## CHROMIC IRON.

For a number of years the only product of chromic iron ore in the United States has been from California. Its occurrence is noted in a number of counties, but it is now mainly produced in Alameda, Glenn, San Luis Obispo, Shasta, and Tehama. The industry of mining and shipping this substance is not very flourishing, owing to the facility with which it can be imported from Asia Minor. Our local product is only about one fourth the total consumption at Baltimore and Philadelphia. Ores producing less than 50 per cent cannot be handled and shipped to compete with those from the Mediterranean. Owing to the "pockety" nature of the deposits, it is difficult to determine anything about their extent except by actual work, and the deposits or pockets

are usually soon exhausted. The substance is generally mined on a royalty to the owner of the land where it occurs. The necessity of building roads to new deposits, when possibly only a few hundred tons may be taken out, prevents many known ones from being worked. Cost of transportation to the only markets, Baltimore and Philadelphia, by sea or rail, is the main reason which prevents California supplying the entire demand of the United States.

#### ALAMEDA COUNTY.

*Douglas Mine.*—It is in Cedar Mountain District, 12 miles S.E. of Livermore. In 1893 the product was about 50 tons of chromic iron, which is still on the dump. It is not as high grade as that of the Mendenhall Mine, and being a harder ore, will require crushing and concentrating to materially raise the grade. D. Mendenhall, of Livermore, owner.

*Mendenhall Mine.*—This is on the S.W. side of Cedar Mountain, 13 miles S.E. of Livermore. The mine produced in 1893 about 55 tons of high-grade ore, and there now lies sacked on the dump several hundred tons of ore, most of which is soft and has been mixed in mining with a great amount of waste. The soft, friable character of the ore, however, will render it an easy matter to wash it. Simply raking the ore in a puddling-box similar to that used by placer miners, and placing two or three lengths of sluice-boxes, provided with riffles, below, should result in raising this ore to an average of at least 50 per cent, and may do even better. The deposits are exceedingly variable in thickness and in dip. The ore bodies appear to lie in rolls and to occupy portions of the serpentine that are much crushed and broken. Some of the ore has a structure similar to decomposing serpentine, and appears to be a replacement of the serpentine itself by chromic iron. A. Mendenhall, of Livermore, owner.

#### DEL NORTE COUNTY.

*Tyson Mine.*—See our Xth Report, p. 169. No shipments are made at present, the demand being small. Tyson Mining Company, of Baltimore, Md., owners.

#### GLENN COUNTY.

*Whitlock & Oakes Mine.*—It is situated on a ridge of serpentine which rises to an altitude of about 3,000 ft., and forms the W. side of Milsap Valley. It is reached by a steep mountain road 3 miles in length from the mine to the Newville and Fruto county road. The workings consist of an open cut about 70 ft. long and 30 ft. deep, and a chamber about 20 ft. wide and 50 ft. in length. The deposit shows a mass of chrome more than 10 ft. in thickness, which in places is somewhat mixed with serpentine. During 1893 the mine was worked on a royalty, 15 men being employed; 3,319 tons of chromic iron were shipped. J. R. Whitlock, of Paskenta, Tehama County, and F. Oakes, of Newville, Glenn County, owners.



## MARIN COUNTY.

On the *Mailliard Ranch*,  $7\frac{1}{2}$  miles W. of San Rafael, are several small deposits of chromic iron, none of which have been opened. As usual these bunch-like masses of ore occur in serpentine, and are very irregular. Analyses determined the ore to contain over 50 per cent chromium sesquioxide. A. Mailliard, of San Rafael, owner.

## NAPA COUNTY.

Adjacent to the Snowflake Mine is an outcrop of chromic iron of good grade.

## SAN LUIS OBISPO COUNTY.

*Pick and Shovel Mine.*—This mine is located 4 miles N. of San Luis Obispo, and about half way to the summit on the western slope of the Santa Lucia range. Work has been carried on here irregularly for seventeen years. There are 2,500 ft. of tunnel; the longest is 900 ft. The chromite occurs in bunches and stringers in a crushed zone. One bunch of 1,000 tons has been taken out. The chromite is found impregnating the serpentine as well as in almost pure masses. The bunches and connecting stringers are arranged in such an exceedingly irregular manner that no rule can be laid down for tracing the ore bodies.

The manner of occurrence of chrome ores is perhaps better shown here than in any other mine on the Pacific Coast, on account of the extensive workings. The fact that the chromite is confined to this crushed zone, and the serpentine gangue more or less silicified in places, seems to indicate a manner of deposition for this mineral similar to that of quicksilver. The chromite would thus not be an original constituent of the serpentine in the form or position in which it is found, but because of its invariable association with serpentine it was undoubtedly an original constituent in some form, perhaps disseminated through the mass and afterwards collected by means of mineral solutions. See our Xth Report, p. 583.

*San Carpojoro Creek and the Arroyo La Cruz.*—On the divide between them chromite is found. It is reported to be one of the largest deposits ever found in the county. It is almost inaccessible, and owing to the great expense of constructing a wagon road, has never been opened.

*San Luis Obispo Deposits.*—The chromite deposits 4 miles W. of San Luis Obispo have been worked to a small extent the past year, and something less than 100 tons taken out. No large bodies seem to have been found recently in the serpentine, but the greater portion was obtained from the gulches and hill slopes below the mines, by collecting the surface debris and sluicing it. The chromite appears disseminated through the serpentine in small stringers and bunches which can hardly pay for working. See our Xth report, p. 583.

## SANTA BARBARA COUNTY.

A few tons of chromic iron have been mined 10 miles N. of Santa Ynez, but it is so far to market that it is not available.

## SANTA CLARA COUNTY.

*Hahn's Ranch.*—There is a deposit of chromic iron of limited extent here. Some years ago a small prospect hole was sunk on it, but since that time nothing has been done.

## SIERRA COUNTY.

*Brandy City.*—Chromic iron, in small quantities, is found here on Sec. 1, T. 19 N., R. 8 E., but is not being mined.

## SONOMA COUNTY.

*Sonoma Switch.*—Several large detached bodies of chromic iron are to be found half a mile from this station, with some little prospect work expended on them.

## TEHAMA COUNTY.

*Tehama Consolidated Chrome Deposit Company.*—The chrome deposits which are being worked by this company are situated on the North Fork of Elder Creek, and in Sec. 16, T. 25 N., R. 7 W., M. D. M. In this section chrome ore is exposed in five or six different places. The principal development consists of an open cut, where a body of ore more than 20 ft. in thickness is exposed. The wall rock is serpentine. During 1893, 3,200 long tons of ore were shipped from this mine; and in August, 1894, a new contract was being executed, which called for 1,500 long tons of chrome to be delivered f. o. b. at Red Bluff for \$9 a ton. Twenty men are employed. See also our Xth Report, p. 692. Tehama Consolidated Chrome Company, of Red Bluff, owners.

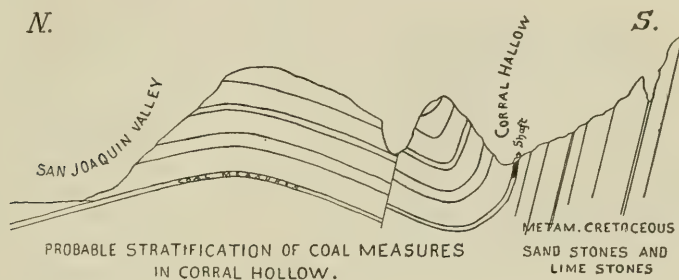
## COAL.

The coal product of California comes from the counties of Amador, Contra Costa, Fresno, Monterey, Riverside, and San Diego. The largest yield is from the mines of Amador and Contra Costa, the latter being first in importance. The entire product of the State is now only about 75,000 tons per annum, an annual decrease of output being shown since 1889. The coals of the State are generally of an inferior character as compared with those imported. About 1,500,000 tons of coal are consumed in California yearly. About one third of this comes from British Columbia; one third from England and Wales; and the rest is from the East, Japan, Scotland, Oregon, Washington, and the local mines. With such a large domestic consumption, and so small a local output, the importance of exploiting and developing known coal "prospects" is apparent to any one. There are many places in the State where coal is known to exist, but where very little if any work has been done. The latest field of investigation is in Mendocino and Humboldt counties, which is more fully referred to further on in this chapter. Every encouragement should be given toward the development of this and other localities where there are indications that coal may be found. An interesting table of analyses may be found at the end of this chapter.

## ALAMEDA COUNTY.

*Corral Hollow Coal Field.*—Considerable prospecting for coal has been done since 1862 in Corral Hollow Cañon and on Richard Creek, in the east end of Livermore Valley, and several thousand tons of good coal have been taken out and sold in the vicinity. The last description was published in our Xth Report, p. 91. At that time the rather shallow mines which had produced the coal had been closed down, being rendered worthless by excessive faulting. Since then all the mines on the Livermore side of the hill have been shut down for the same reason.

The coal measures in Corral Hollow are similar to those of Mt. Diablo, and are probably a continuation of that field; at least they belong to the same geological age. They contain three fair-sized veins of coal, with a number of thin seams and irregular streaks between. They are bedded on a white or reddish-white sand, which in places coheres enough to be called a sandstone. Between the veins lie a bluish clay, interspersed with seams of sand. The upper stratum is blue clay about 75 ft. thick.



The whole coal formation measures perhaps 200 ft., and is covered up by a bed of soft-gray and bluish-gray sandstone 800 to 1,000 ft. in thickness. The lower stratum of this sandstone contains limonite in nodules and concretions, and the upper, fossil wood and oyster shells.

The only attempt at mining in this neighborhood at present is some prospecting by Mr. Treadwell. Where the wagon road from Livermore enters Corral Hollow Cañon, a tunnel is run on a course N. 36° W. with a view of striking the coal several thousand feet E. and N. of the old workings in Richard Creek, and at a considerable depth underground. Entrance to the mine and information of every kind was refused, but to judge from the size of the dump there must be a mile or more of drifts. The tunnel has a double track and seems to be well timbered. There is an air compressor and a fan, and an electrical plant, indicating an underground hoister.

Going down Corral Hollow from the tunnel the course of the creek is N. 75° E. for about 5 miles, the coal measures crossing it at a small angle, the average strike of the veins being N. 80° E. Below the tunnel  $2\frac{1}{2}$  miles, the same party has opened a shaft or incline on the S. side of the creek. There is a boarding-house, a shaft-house, and hoisting-plant. The "opening" is at the base of the hill, and about 15 ft. above the creek. Between the tunnel and the shaft lie the old workings, and some of them are still open. They illustrate how very much the strata have been twisted and broken. In the first drift entered the dip was 45° N.; at



the next one, only a short distance beyond, it was nearly 34° W. About a mile below a small gulch comes in from the S., and in it metamorphic sandstone and limestone outcrop, standing nearly perpendicular. Opposite the shaft the strata dip at a high angle to the N., and seem to lie as illustrated in the sketch on page 39.

The coal measures no doubt continue down the creek for several miles, but as the hills are covered with soil no exposures were noted. The bottom ledges of the gray sandstone will be a sure guide to the prospector. On the W. side of the divide, on Richard Creek, the gray sandstone overlying the coal is about 500 ft. thick. The hills become lower as we go W., the strata dipping to the N.W., until the coal, and even the sandstone, disappears below the level of Livermore Valley. There is every evidence on the surface that the coal measures have been subjected to repeated disturbances, and heavy faulting and crushing of the veins may be expected underground. The sand strata, wherever they exist as a roof in contact with the coal, render mining a most difficult operation. It is to be hoped that the long tunnel has struck ground not so much disturbed, so as to reimburse the owners for the great sums of money expended. The quality of the coal is similar in all respects to that of Mt. Diablo. It has a bright black color, is brittle, and crumbles readily on exposure to the air. At the tunnel two varieties are brought to the surface. The one said to come from the lower vein is very fragile, and contains an excessive amount of gypsum and pyrite. The other, supposed to come from the middle vein, looks much better; it is harder and contains less impurities. The coal from the lower workings (the shaft) is nearly of the same quality as the best from the tunnel. At this place is another variety, probably coming from another vein. It is tough, does not crumble, and has a dull, brown-black color. It is highly bituminous and burns readily with a long flame when heated. It is an excellent gas material, and may be called a cannel coal.

#### AMADOR COUNTY.

*Ione Coal Field.*—In the vicinity of Ione, some 36 miles S.E. of Sacramento, a heavy bed of coal has been worked to a small extent for a number of years. Behind the first ridge of the lowest foothills of the Sierra a series of lakes existed in ancient times, in which depressions the coal was formed. These extended from a short distance south of the Cosumnes River in the north to Jackson Creek in the south, and possibly farther. The formation consists of light-colored clays interstratified near the surface with carbonaceous matter and sand. It belongs to the Tertiary age, and lies non-conformably upon the Cretaceous rock below. The surrounding hills are Cretaceous sandstones capped with lava or conglomerates.

The coal is a brown coal. When taken out it is dull black, changing to brown and yellow-brown as it dries. It is soft and easily cut with the knife, and contains a large amount of *ionite* (a light, very fragile, dirty-yellow, earthy-looking hydrocarbon, found exclusively in this field), and also *gilsonite* and *rosin*. It carries a great deal of water as it leaves the mine, and in that state bears handling well, but as it dries it cracks and crumbles, for which reason it is shipped as wet as possible. It is used to a small extent for house coal in the vicinity, and is shipped to Sacramento, Stockton, and other points.

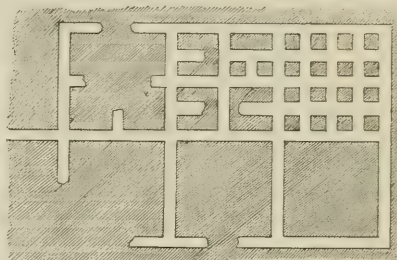


Used under the boiler it must be fed in frequently, in thin layers, and must have plenty of air. Furnaces especially constructed are used in Sacramento. If the fireman has once learned to handle the coal it makes a satisfactory and cheap fire.

To make this field to yield its full value some means should be found to utilize the coal on the spot. A gas plant may be erected and gas piped to Stockton or Sacramento, where it would be used in preference to any kind of coal; and as there is fuel, sand, and clay of excellent quality in abundance, a large pottery might be started, in which all kinds of chinaware could be manufactured. The increased demand for coal produced by such enterprises would reduce the cost of mining by rendering a systematic and economic way of mining feasible.

There are only two mines in operation—Mine No. 3 of the Ione Coal and Iron Company, and that of the Sacramento and Ione Coal Company. Both were described in detail in our VIIIth and XIth Reports, pp. 110 and 147.

*Ione Coal and Iron Company's Mine No. 3.*—The coal here is mined through tunnels only. From the base of the hoisting slope a gangway is driven as far as it is desired to work the coal through that slope, then tunnels are run right and left, 6 ft. wide and 50 to 60 ft. long, with a pillar left between 50 ft. thick. The short tunnels are next connected at their further end, so that now a pillar stands clear 50 ft. square. The next step is to divide this pillar by a tunnel 6 ft. wide in one direction and afterwards in another direction, leaving four pillars 22 ft. square; these are again cut crosswise, until finally sixteen pillars remain, each 8 ft. square. Two fifths of the coal in the whole area is left in the mine as pillars and probably another half fifth as roof.



MANNER OF MINING COAL  
IN MINE NO. 3.

Occasionally the clay above the coal is replaced by sand charged with water, and whenever that occurs a cave results, filling the workings for several hundred feet in every direction with quicksand. The coal dips slightly toward the center of the basin, and averages about 9 ft. in thickness throughout the mine. The quality varies somewhat, some streaks being brighter than others, although in mining it will be impracticable to keep them apart. The vein is made up as follows:

White clay above.	
Coal, Sample No. 4—left as roof	2'
Gray shale	4"
Coal, Sample No. 3	2'
White clay	3"
Coal, Sample No. 2	3'
Coal, Sample No. 1	4"
Clay in bottom.	10"

The seam of white clay varies greatly in thickness, measuring in one place more than a foot, although the coal at that point was about as thick as elsewhere. Several faults, the largest of which is 2 ft., were noticed.

*Lancha Plana Coal Field.*—This deposit is 10 miles S. of Ione, and is considerably older geologically than that at Ione. The Murray and the Orr mines are the only openings.

The coal is a brown coal, which when taken out is black, and resembles the Ione coal; when dry it crumbles, changing to a light brown, with small black particles and thin seams of clay and other impurities showing in the mass. It contains a great deal of ash, but as nearly half of its weight can be driven off by heat, it may be considered a good gas coal. The exploration of this coal field has been very limited; only a few openings have been made, and they are close together. How far it extends, or whether it crosses the Mokelumne River into Calaveras County, is not known, as no shafts or borings of sufficient depth came under the observation of the Bureau to determine.

*Murray Mine.*—This mine has been idle since it was described in our VIIIth Report, p. 109. The workings are caved or are full of water.

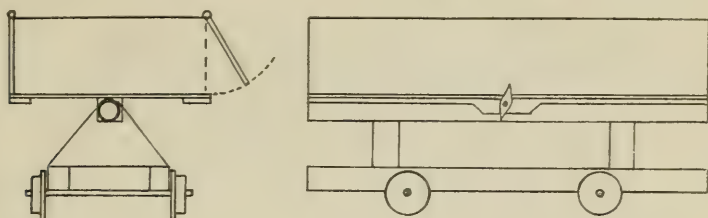
*Orr Mine.*—This is in China Gulch,  $1\frac{1}{2}$  miles S. from the Mokelumne River, and  $2\frac{1}{2}$  miles E. of Lancha Plana. China Gulch is a small valley, varying in width from 500 to 1,500 ft. Some of the land is under cultivation, and fruit of all kinds seems to do well. The surrounding hills are made up of white and yellow Cretaceous sandstones, unaltered and little disturbed. They dip slightly to the S. The two-compartment shaft, 104 ft. deep, is sunk on the slope of the hill some 30 ft. above the creek and is newly timbered. Hoisting is done by direct horse power. At the bottom of the shaft a short tunnel starts off in a northerly direction, and from it all the coal sold is taken. The vein, which is 4 ft. thick, lies practically level. There is no water in the mine. Below the coal lies blue clay and above it a very soft white sandstone. But two men are at work, and they only occasionally. Little or no attempt has been made to introduce the coal in the surrounding villages. Oak fire wood can be had at a nominal figure, and is preferred therefore by the people. Almost the only demand for the coal at present is at a steam plant in a gravel mine a few miles down the river.

*Sacramento and Ione Coal Company's Mine.*—The coal lies very near the surface, and is brought to daylight through an incline having a very easy slope, showing the following section:

Sand and sandy soil at the surface.....	8'	
White clay.....	4'	
Brown carbonaceous matter.....		7"
White clay.....	2'	8"
Fragile and poor coal, with gypsum.....	2'	
White clay.....		4"
Coal.....	1'	4"
White clay.....		1"
Coal.....		8'
White clay in bottom.....		

Tunnels are driven at the bottom of the slope in every direction, and from them the coal is mined by opening short rooms, 6 by 20 ft., on either side, and robbing the pillars afterwards. The lowest white clay seam shows throughout the mine immediately below the roof. It comes down with the coal in mining, and must be picked out. The next streak of coal, which makes a very good roof, is left for that purpose, little timbering being required. The rails used are T rails of good weight; the cars are arranged to dump at the side, and stand somewhat higher than the common end dumper. They measure 6 ft. 3 in. by 3 ft.

by 1 ft. 3 in. inside, and are made of pine. Mr. Muir, the Superintendent, says that the ground owned by the company is nearly mined out, and that he expects to take out the rest by January, 1894.



### SIDE DUMPING CARS

USED IN THE MINE OF THE SACRAMENTO AND IONE  
COAL COMPANY.

Another mine was opened half a mile N. of Carbondale, and hoisting machinery and buildings were erected. At a depth of 100 ft., 18 ft. of good coal was struck, it is said. The shaft is 6 by 12 ft. and is well timbered. For some reason, not learned, no coal was ever taken out. The mine lies idle and water stands in the shaft.

About  $2\frac{1}{2}$  miles N. of Carbondale another opening was made by Mr. Newman, of Ione, but nothing has been done there since it was described in our XIth Report, p. 148.

### CONTRA COSTA COUNTY.

*Mount Diablo Coal Field.*—A series of mines and croppings are known under this name, which encircle Mount Diablo with a radius varying in length from 4 to 10 miles. They lie on the N.E., N., and N.W. sides of the mountain. The geological formation belongs to the Upper Cretaceous or Lower Tertiary, and the strata dip in every instance away from the center of eruption at Mount Diablo. The dip ranges from  $16^\circ$  in the Brentwood Mine to  $50^\circ$  in the San Francisco Mine. As far as the field has been explored the strata are faulted and broken considerably. Near a fault the coal is always crushed and worthless and sometimes absent altogether. Below, as well as above the coal measures, lie sandstones of great thickness and of white, yellow, or reddish color. The strata immediately above the coal measures generally contain *limonite*.

The coal belongs to the lignites. It has a bright, black luster, is brittle, and crumbles readily to small fragments and dust on exposure to the air.

The coal measures vary in thickness from 350 to 400 ft., and contain three marketable veins of coal. The upper one, known as the *Clark vein*, lies immediately below the sandstone, except where occasionally some inches of clay slate intervene. The coal is bright, of good quality, and remarkably free from slate and bone. This vein has been a favorite in the different camps, and nearly all of it has been mined to a level where water begins to be troublesome. The next important vein, called the *Little vein*, extends through the whole field like the former, but is of



very irregular thickness. In some of the workings it shows a mere seam, while elsewhere it becomes a workable vein of 18 to 24 in. thick. It is more expensive to mine than the Clark vein, as it does not lie in contact with the sandstone, but has a stratum of bone or clay shale 2 ft. thick below as well as on top. The bone swells when exposed to air, and makes a troublesome, if not dangerous, roof and footing. The coal is bright and nearly as clean as that of the Clark vein.

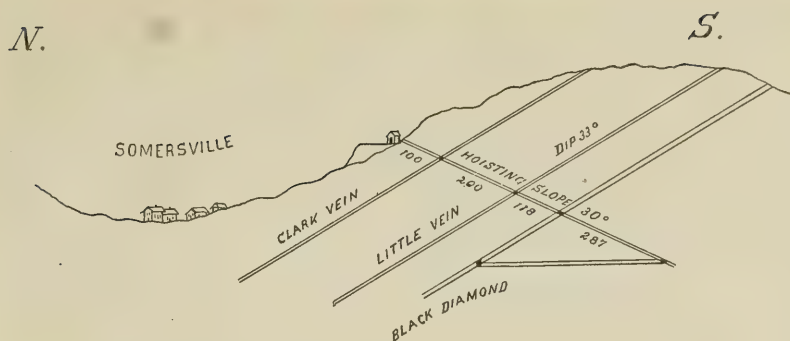
The *Black Diamond vein*, which comes next in order, is generally the thickest of the series, averaging  $3\frac{1}{2}$  ft., but, like the other veins, it varies greatly, sometimes swelling to nearly 5 ft., and half a mile farther pinching down to 24 in., or even 18 in. It is the most expensive vein to mine, as there is bone 4 to 6 ft. thick above and below. The timbers must be placed very close together, and even then it is merely a question of time when they are crushed by the swelling of the bone. This coal is not nearly as pure or bright as that of the Clark vein. An inch or more of clay or slate is generally found about the middle of the vein. Between these three larger veins are a number of veins of carbonaceous matter containing coal seams a foot or less thick. The principal one of these is called the Belshaw, the Bogus, or the Floyd vein. In isolated patches it has been large enough to work, but as a rule it does not pay to extract the coal. The most easterly point at which the vein has been explored lies in Sec. 27, T. 1 N., R. 2 E., at the Brentwood Mine. The veins here proved to be large and the quality fair, but no work has been done on them since they were described in our VIIth Report, p. 145.

*Central Mine.*—See Stewart's.

*Empire and Hartley Mines.*—Farther W. some little work was done in Secs. 16, 18, and 7. The coal found here was dirty and crushed by faults, and the prospectors soon became discouraged and quit. In the next township toward the W.—T. 1 N., R. 1 E.—we find the Empire and West Hartley mines, both in Sec. 12. These have furnished considerable coal, but for the present are shut down. In both the coal has been mined to a level about 400 ft. below the surface. See our VIIth Report, p. 142.

*Somersville Mines.*—The next mines along the croppings of the coal vein are in Section 4 in and around the village of Somersville. They are the *Pittsburg, Union, Manhattan, Eureka*, and others. See our VIIth Report, pp. 117–140. They are all abandoned. With the exception of a small patch in the ground of the Pittsburg Company, and another one in the old Manhattan ground, the coal has been extracted down to where water interferes seriously. This point, called water level in the camp, lies about 350 ft. above the San Joaquin River. The only mine taking out coal lies in the ground of the Pittsburg Company, in a narrow ravine S. of the village. The opening is known as *Davis slope*. In the early part of 1892 work was begun in the bottom of the gulch, and this slope was driven 705 ft. on an angle of  $30^\circ$  in a southerly direction. The Clark vein was struck 100 ft., the Little vein 300 ft., and the Black Diamond 418 ft. from the mouth of the slope. Gangways were run on all three of the veins and the coal taken out nearly to the surface. The Clark and the Little veins were of nearly uniform thickness throughout, the former being 3 and the latter 2 ft.; both contained excellent coal. The Black Diamond was 3 ft. thick at the east end of the gangways, and  $3\frac{1}{2}$  ft. at the west; the coal was fair. When all the coal was mined on





*Underground Working of Davis Slope.*

these levels a tunnel was run from a point 680 ft. down the slope to cut the veins again at that level; this left a sump in the bottom of the slope 25 ft. deep. The tunnel strikes the Black Diamond vein 340 ft. from the base of the slope. A gangway 600 ft. was run westerly along the vein. Many faults were encountered and the gangway had to swing first this way then that, to keep the vein at the proper elevation above the rails. The coal in many places is crushed and worthless; in one instance this is the case for a length of 300 ft. The coal, where it is solid, is of good quality, and shows a thickness of 3 to 3½ ft. The dip ranges from 28° to 33° to the N. No work of any kind has been done on this level on the east side of the slope or on any of the other veins.

The slope is about 8 by 6 ft. in the clear and is not timbered, except where the old upper gangways are closed or where it crosses the smaller veins. The mine makes about 20 cu. ft. of water per hour, which is hoisted in tanks. Mules are used in the gangways and tunnel to move the cars to and from the slope. The hoisting engine has a cylinder 12 by 24 in., and a ½ in. wire rope is used on a 6 ft. drum. All the water used in the boilers is hauled by rail from the San Joaquin River. There are 9 miners employed whenever there is any demand for coal. The total shipments for the first four months in 1893 were only 3,000 tons. Ventilation is had by an upraise from the workings to an old tunnel, and thence up to the surface. A fire is kept burning in the tunnel where the air shaft crosses it, to make a draft. The tunnel just mentioned runs into the hills in nearly the same direction as the slope; its mouth is 300 ft. to the S.W. of the engine-house; it is 800 ft. long, and as it cuts all the veins, a section was measured, as follows:

Starting at the Clark vein, which crops out on the face of the cliff outside the tunnel—

Yellow sandstone, to mouth of tunnel.....	78'
Yellow sandstone.....	17'
Good coal.....	1' 3"
Grayish sandstone.....	130'
Good coal.....	3'
Black slate.....	1' 6"
White sandstone.....	8'
Bone.....	3'
Dirty white sandstone.....	56'
Black slate and clay.....	30'
White sandstone.....	46'

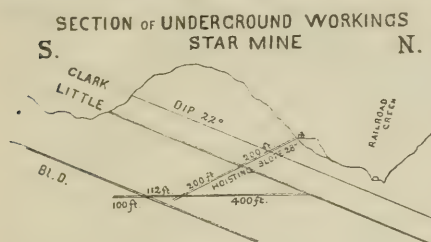
Black slate.....	6	
Yellow soft sandstone .....	90	
Thin seams of slate, bone, and clay .....	30	
White sandstone.....	80	
Good coal.....	1'	
Black slate.....	2'	
Gray sandstone with thin seams of clay, slate, and bone.....	67'	
Coal.....	2'	3"
A fault.....	12'	
Black shale.....	4'	6"
Dirty coal.....	3'	6"
Dirty white sandstone with seams of shale.....	95'	
Black slate.....		9"
Yellow sandstone.....	91'	
Bone.....	6'	
Coal.....	4'	6"
Bone.....	6'	
Sandstone at face.....		

*Star Mine.*—The Star Mine is in Sec. 11, and as this mine is one of the few producing coal at present, a description is herewith given of its underground workings.

An incline was sunk in a S.W. direction on a slope of  $28^{\circ}$  to a depth of 430 ft., cutting the veins at an angle of about  $50^{\circ}$ . When the Clark vein was struck it proved too thin to work; the Little vein, however, showed good coal of fair thickness. It was crossed at a depth of about 200 ft. Gangways were driven on the vein at this place, both E. and W., 850 and 700 ft., respectively, and the coal extracted between the gangway and the surface. These workings are now closed. At the base of the incline water was encountered, and as the Black Diamond vein has not been crossed, and as it was not desirable to go any deeper, a sump 30 ft. deep was left at the bottom of the incline, and a tunnel driven in the same direction as the incline. It struck the Black Diamond vein at a distance of 112 ft. The coal, however, contained so much bone and slate that it was worthless. Altogether the vein looked so different from its usual appearance that doubts arose whether it really was that vein or another, and to decide the question the tunnel was continued 100 ft. farther. No more coal was found and the work ceased. On the same level another tunnel was run, in nearly the opposite direction. It lies partly under the incline, and is nearly 400 ft. long to where it strikes the Little vein, and at its end two gangways are driven on that vein. The one to the W. is about 720 ft. long, and as its end lies in a large fault of unknown thickness, it is not intended to extend it. The coal is nearly all mined from this gangway, and it is expected that by the end of May the last of it will be cleaned out. The lift, the distance between this gangway and the one above, measured along the coal is 192 ft. The gangway to the E. is about 700 ft. long, and will be extended from time to time as new ground is needed, or until it strikes the old workings of the West Hartley, whose lowest gangway is about on this level, and probably 100 ft. from the present face. Should this connection be made it will create ventilation in both mines. As mentioned above, the Little vein is the only one mined here at present, and the coal is clean and bright. Near the E. end of the claim it is 20 in., and at the W. end 30 in. thick. The dip is from  $20^{\circ}$  to  $24^{\circ}$  N.,  $10^{\circ}$  W. The white sandstone roof sometimes rests directly on the coal. From 1 to 16 in. of bone and slate generally, however, intervene. The bottom is a nearly uniform bed of blue slate 4 ft. thick, with white sandstone below. It is not intended to deepen the slope when the coal on this level is worked out, as it would

get too far away from the coal. The locality for a shaft has been selected which will strike the coal 400 ft. deeper, and it is intended to work both the Hartley and the Star mines through this shaft when sunk.

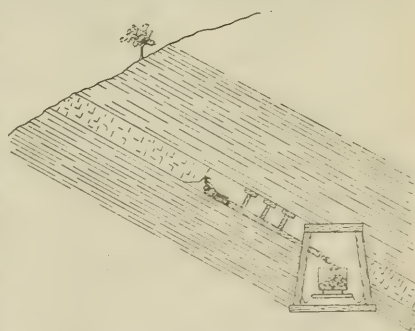
No powder is used to mine the coal, the pick being sufficient. In driving the gangway, where sandstone is encountered, No. 2 giant powder is employed, and two men working together drive about 6 ft. per



day. There is as yet no necessity of artificial ventilation in the mine, as quite a draft exists through the old workings. Several small faults were cut through; the largest "jump" in the lower workings was  $2\frac{1}{2}$  ft., while on the upper gangway it was 9 ft. The mine makes about 100 cu. ft. of water per hour, which is hoisted out of the sump by a 300-

gallon wooden tank, set on regular trucks. It is supplied with a valve in the bottom, so as to fill it as it sinks into the water of the sump. The hoisting engine has a cylinder 10 in. by 12 in., and a winding drum  $6\frac{1}{2}$  ft. in diameter. Hoisting is done with a velocity of about 8 ft. per second. The mine employs about 40 men at present, but the number fluctuates constantly. The coal is shipped as it comes out of the mine, no screening being attempted.

In all the mines of this neighborhood the coal is mined in rooms 30 ft. wide and as long as the distance may be to the next gangway (a lift, generally 400 ft.). The gangway is driven somewhat below the coal, in such a way that the bottom of the vein lies about 5 ft. above the floor of the gangway. An opening 4 ft. wide is made in the coal, which gradually widens to the width of the room—30 ft. The coal is run down into the gangway through a chute made of boards and lined with sheet-iron; it is 3 ft. wide and 6 to 8 in. deep. As the miner works his way up in his room he adds length after length to his chute, until he reaches the next gangway above. He does nearly all work on his knees or lying on his side. As soon as he has sufficient coal picked loose to make it inconvenient he shovels it into the end of the chute; here it is taken charge of by a boy (called a nobber), who works it down the chute. At the lower end a board is set across the chute to prevent the coal from wasting until a car is pushed under to receive it. The cars are hauled by mules or pushed by men along the gangway to the slope, and there hoisted. Whale oil is used to keep the chutes slick, and about one gallon is reckoned for that purpose per miner per day.



MANNER of MINING COAL

Props of redwood with a short cap are put in as soon as the coal is taken out. An average of one prop for every square yard of space is required; in addition to this some extra timbers are put on each side of the chute. In bad ground cribs are used, built up of short posts and



filled with stone (cogs). The gangways and tunnels have a 1 per cent grade toward the foot of the hoisting slope in order that the water may drain from the whole mine into the sump and the loaded cars run easily.

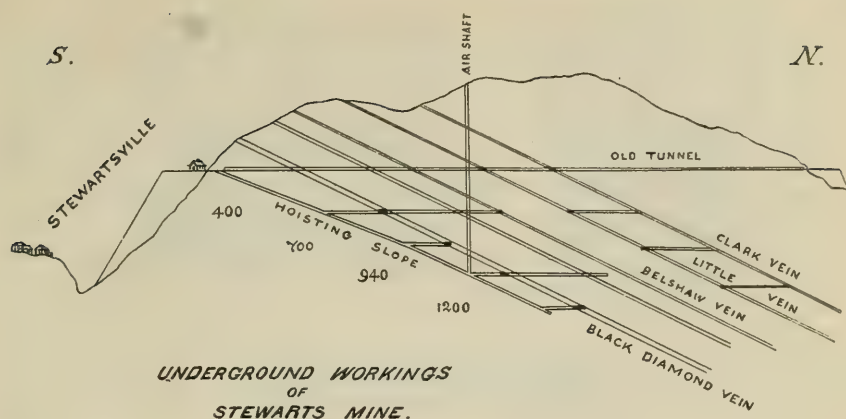
*Stewart (Central) Mine.*—The next toward the W. is the Central or Stewart Mine at Stewartsville. This mine lies nearly in the center of Sec. 10 on the S. slope of a very steep sandstone ridge. It was opened many years ago by a tunnel driven N. entirely through the hill; after crossing the other veins the Clark vein was struck at a distance of 1,000 ft. from the mouth. It proved to be the only good coal found. Gangways were driven at this place and all the coal extracted from above; a slope was then sunk 900 ft. on the pitch of the vein, a hoisting engine placed at the head of it, and the entire coal extracted. Then from the bottom of this 900 ft. slope a tunnel was run S. 218 ft., where it struck the Little vein. Coal from this vein was mined here and there, and as high up as possible wherever its thickness admitted of doing so at a profit. The Black Diamond vein was not prospected at this level, as further progress was stopped by insufficient ventilation, caused to some extent probably by the underground hoisting engine. Water also came in at the rate of 150 cu. ft. per hour, so work was temporarily stopped. Later the present workings were opened by driving a slope down 1,200 ft. near the mouth of the old tunnel, at an angle averaging 20°, and sinking an air shaft 312 ft. from top of the ridge to the old tunnel, and thence down, at an angle of 55°, until it struck the 1,200 ft. slope at a point 900 ft. from the surface. The first tunnel to tap the coal was driven at a point on the slope 400 ft. from the surface; it cuts through 160 ft. of light-grayish sandstone and strikes the Black Diamond vein.

*Section of Formation Penetrated by the 400 ft. Level.*

Gray sandstone.....	160'
Black shale and bone with 6 in. coal	6'
Black clay.....	6'
Coal of good quality.....	2'
Clay.....	2''
Coal not as good as above.....	1' 6''
Dirty white slate.....	5'
White sandstone.....	200'
Shale and bone.....	10'
Coal.....	10''
Bone.....	10''
Coal.....	1'
Black shale.....	2'
White sandstone.....	105'
Black shale { Belshaw vein }	5'
Coal { }	2' 6''
Yellow sandstone in face of tunnel.	

The upper old tunnel for quite a distance runs along in a fault, and no sign of the Belshaw vein was noticed; later, when the air shaft was sunk, the vein was crossed in good ground and proved to carry 2½ ft. of excellent coal. Up to that time the Black Diamond vein was the only one worked from the new slope, as the Clark and Little veins had already been mined through the old workings. The result was that the tunnel on the 400 ft. level was extended and the Belshaw vein struck as shown above. A gangway 800 ft. long is driven on it toward the W., and the coal is being extracted there now. The vein has a dip of 25° to the N., and as a rule the roof is clean white sandstone, although in places a few inches of shale intervenes. The bottom is 5 ft. of shale.

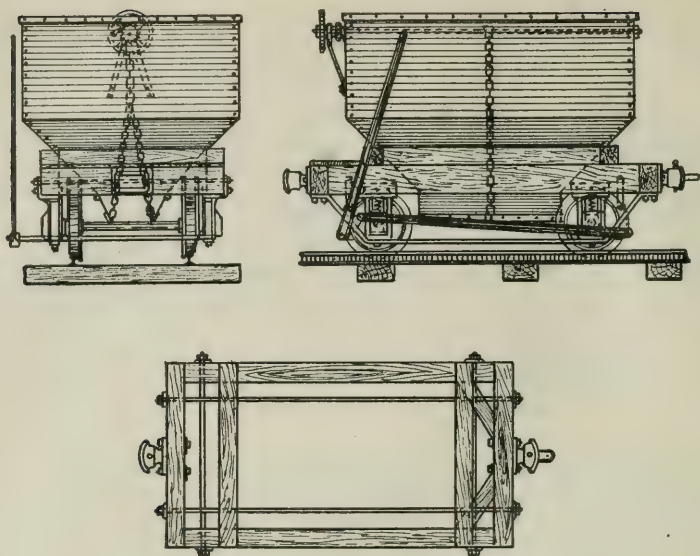




The coal averages 30 in. thick, and is clean and bright. It is intended to drive the gangway some 200 ft. farther, to a large fault known to exist there. About 15,000 sq. yds. of the vein have been extracted. At a point 700 ft. down the slope a tunnel was run to mine the coal of the Black Diamond, and another one 940 ft. down is being extended at present to cut the Belshaw vein. It is in 320 ft., and it is expected that the vein will be struck within the next 40 ft. At the base of the slope, at the 1,200 ft. level, there is another tunnel, which cuts the Black Diamond vein. But very little coal has thus far been taken from here.

The hoisting slope cuts through solid yellowish sandstone all the way down. It is 6 by 6 ft. in the clear and not timbered. The tunnels are timbered wherever they cut the different veins or carbonaceous streaks. The sandstone does not require timbering. The gangways are timbered throughout with 8 by 8 in. timbers. Props are redwood, 3 ft. long, and averaging 5 by 5 in. square. Ninety props make a cord, and cost \$6 25 in Antioch. In tunneling two men make about 7 ft. per day. Giant No. 2 is used in  $1\frac{1}{4}$  in. cartridges, and boring is done with hand drills. The ventilation throughout the mine is good. Water is hoisted in self-filling wooden tanks at the rate of 120 cu. ft. per hour from the sump on the 1,200 ft. level. The engine has a cylinder 12 by 20 in., and a  $\frac{7}{8}$  in. wire rope is used, winding on a drum 7 ft. in diameter. The rope is run at a speed of 9 ft. per second. Water for the boilers is brought up by rail from Antioch; about 3,000 gallons are used per week. The coal in the different veins, as far as they are mined, was of uniform quality, except, of course, where it was crushed by faults. Small faults are quite numerous, and large ones exist on the western as well as the eastern end of the claim; both are about one fourth of a mile from the main slope. It was noticed that the coal was 3 to 4 in. thicker at the west than at the east end of the workings. About 30 men are employed about the mine, but like the Star Mine the number varies greatly from time to time. The coal is screened into two qualities—a nut coal and slack. A narrow gauge railroad carries the coal from the Star and Central mines to Antioch, where it is dumped into barges and sold. Shipments from these two mines average 3,000 tons per month.

The next mines farther west lie in Secs. 5, 6, and 7. See our VIIth Report, pp. 117–140. Abandoned in 1886. The railroad to the river



— CARS USED ON RAILROAD FROM ANTIOCH TO STEWARTSVILLE —

was torn up and everything of value taken away. The village of Nortonville is nearly deserted, and the old shafts and tunnels are full of water and are caving.

#### DEL NORTE COUNTY.

The Mount Diablo coal mines, once a center of great activity, are passing away, one after another. What little coal is still mined can hardly find a market. The consumer objects to the coal on the ground that it crumbles rapidly, that it contains too much ash, but principally that a better grade of coal can be obtained in the market at nearly the same price.

*Hodgkins' Claims* lie on the beach about 2 miles N. of Crescent City. See our XIth Report, p. 198. No further development has been made. The coal is a true lignite, brown in color and tough in texture. W. H. Hodgkins, of Crescent City, owner.

#### FRESNO COUNTY.

*California Coal Mine.*—(See Coalinga Coal Field.) The present workings consist of an 80 ft. tunnel to the "Little" vein, the only one worked in this mine, and a gangway 1,320 ft. toward the south along the vein. The face of the gangway shows the following section:

Clay on top.	
Gray sandstone.	3'
Shelly conglomerate, rotten and soft	1'
Coal—Little vein	2'
Light-gray clay	3' 6"
Dark-gray, slick clay in bottom.	

Although the dip is  $33^{\circ}$ , sheet-iron was used in the chutes. From the gangway a cross-cut was made to the west, and several small streaks of coal were found, but before the "Big" vein was reached water came in and the work was stopped. The mine is dry, except where the cross-cut enters the gangway. About a barrel of water is dipped up at that place daily. The manner of mining is the same as in the San Joaquin Mine. The clay here, being dry, does not swell, and but little timbering is required; 6 by 6 in., and even 4 by 4 in. posts seem to do the work required of them. The cars run on strap rails, pushed by men and dumped at the bunkers. The coal is hauled by wagon 5 miles to Coalinga, on the railroad. In 1893 the average shipment was 100 tons per month. The coal looks somewhat brighter than that of the "Big" vein, and contains less ash.

*Carey Creek Coal.*—On the north side of the metamorphic ridge, where the hills are not covered so deeply with soil, coal has been found in many places. On Mr. Frame's place, in Sec. 6, T. 22 S., R. 14 E., prospectors are at work. They are said to have a vein of good hard coal 6 ft. thick. Their cut was filled up by a landslide, and they are now at work on a tunnel to cut the vein in a better place. The locality lies perhaps only 100 ft. above the metamorphic rock, and the strata dip  $45^{\circ}$  N.E.

*Coalinga Coal Field.*—In the S.W. corner of Fresno County, at the end of the railroad from Goshen to Alcalde, two veins of coal crop out along the lowest foothills of the Coast Range. In nearly every one of the many little cañons for 20 miles N. as well as S. from Coalinga the carboniferous strata can be noticed. As a rule they dip away from the range at a rather high angle. Very little work has been done in the way of prospecting, and except in the vicinity of Coalinga no coal is mined because of lack of transportation facilities. Two veins are large enough to mine, of which the upper one, containing probably the best coal, is called the "Little" vein. It varies in thickness from 6 in. to 2 ft.; the lower one, called the "Big" vein, is  $4\frac{1}{2}$  ft. thick where it is now mined. The coal measures are covered with a series of thin beds of soft, light-gray sandstones interstratified with argillaceous shales. Two mines are being worked on these veins, viz.: The California and the San Joaquin Valley mines.

*Drabble Mine.*—On the eastern edge of Priest Valley, in Sec. 26, T. 20 S., R. 12 E., two tunnels were run into the hill by Mr. Drabble. The cropping shows two large veins of carbonaceous matter; the lower one is probably 100 ft. thick and contains three workable seams of coal; the upper one is not nearly so thick. The tunnels are cutting the lower cropping only. The first one starts in a little ravine high up on the hillside and 25 ft. below the cropping, and runs 71 ft. nearly N. to a gangway on the vein, which was driven 65 ft. to the E. The vein at the face of drift shows 3 ft. of clean, bright coal. The tunnel cuts the strata below the coal as follows:

Mouth of tunnel.		
Gray sandstone.....	23'	
Blue clay.....	5'	
Thin seams of coal and sand.....	1'	4"
Bone.....	1'	
Coal.....		7"
Bone.....		8"
Coal.....		6"
Blue clay and bone.....	5'	6"
Gray, soft sandstone.....	20'	
Gray clay.....	4'	



Sand .....	3'
Gray clay .....	6'
Coal .....	3' 1"
Hard blue slate.	

The second tunnel is only just begun and lies in another gulch, probably 1,000 ft. farther down the creek, and starts on the cropping. The dip is  $61^{\circ}$  N., and the strike  $S. 70^{\circ} E.$ , and, as is generally the case in gulches, there is a fault in this one. No doubt as the tunnel advances beyond the influence of the faulting the coal will come in with its proper thickness of 3 ft.

On completion of a wagon road, which is in course of construction, Mr. Drabble intends to ship coal to the cities in the San Joaquin Valley via Alcalde. The quality of the coal seems to be somewhat better than that of the Black Diamond vein at Mount Diablo. A tunnel run into the hill at the bottom of the gulch would strike the coal in 800 or 900 ft., and have stoping ground above it of perhaps 700 ft., while the mine would drain itself should water come in.

There is a tendency among prospectors and miners to make their openings in gulches, and this may be the proper thing to do under certain circumstances, but it is decidedly wrong in prospecting or mining for coal. In soft sandstone, thrown up from its original level position, a gulch is almost always the result of a fault or break in the strata. The coal is the most fragile layer in the formation, and in faulting it will be the first to be crushed and mixed with the accompanying clays to form bone, or it may be burnt by the heat generated and leave nothing but ashes. At any rate the prospector does not gain the information he desires (*i. e.*, thickness of vein and quality of coal), and has to use two sets of timbers where in solid ground he would use but one.

*Priest Valley Coal Field.*—By far the most important discoveries of coal thus far made in the State are in the neighborhood of Priest Valley in the Coast Range. The beds extend through T. 22 S., R. 14, 13, and 12 E.; T. 21 S., R. 14, 13, and 12 E.; T. 20 S., R. 13 and 12 E.; T. 19 S., R. 12 and 11 E.; and through R. 10 E., T. 18 and 17 S., in San Benito, Fresno, and Monterey counties. The coal occurs in a soft, dark bluish-gray, Cretaceous sandstone several thousand feet in thickness, lying on both sides of a high ridge of metamorphic rocks, which traverses the country in a N.W. and S.E. direction. It forms the divide between the waters of the San Joaquin and Salinas rivers from the S. line of T. 22 S., R. 14 E. to about the center of T. 20 S., R. 12 E.; thence it swings more to the W. and crosses Lewis Creek about 3 miles above the mouth of Oat Cañon. It includes the Stone Cañon and the Drabble Mine croppings on Carey and Warthen creeks, and extends through Priest Valley into San Benito County.

*San Joaquin Valley Company's Coal Mine.*—Since our XIth Report, p. 217, at a depth of 200 ft., a tunnel 150 ft. long has been run in a westerly direction from the incline and struck the "Little" vein in a fault. The coal in this vein, although of good quality, was only 1 ft. thick. Turning to the N. here they drove the tunnel along the vein 200 ft., but as the thickness did not increase the vein was abandoned. They then turned to the W. again and drove 70 ft. and found the "Big" vein. A gangway was then run 250 ft. toward the N.W., and coal is being mined from there now. The lift is 225 ft. The dip of the coal varies from  $32^{\circ}$  to  $40^{\circ}$  toward the E. The mine makes about 240 cu. ft. of water



per hour, and by far the most of it comes from the streak of soft sandstone below the "Little" vein. At the foot of the slope a stratum of hard bituminous sandstone, with shells, was cut through, from which black petroleum exudes and flows down into the sump. The blue clay above and below the coal causes great trouble and expense in this mine. As soon as a gangway is opened and the clay exposed to the air, it swells and squeezes the timbers out of shape or crushes or breaks them where they cannot give. The timber used is 10 by 10 or 12 in. sawed pine, with lagging of 2 in. plank. Old redwood railroad ties are used to some extent for props and caps. The coal is mined in rooms 30 ft. between chutes, leaving a pillar alongside of the gangway 25 ft. thick. There is no pillar left between the rooms, everything being taken out. The dip of the vein is sufficient to run the coal in the chute without the use of sheet-iron and oil. In the rooms a post and cap is set every 3 ft. in all directions. The 7 in. of gray slate comes down with the coal and must be picked out. The ventilation is good without artificial draft, the air circulating through the old workings above. Much gas was expelled soon after the lower tunnels were driven, and some of the men were slightly burned, but at present there is none worth mentioning. The coal of the "Big" vein is not as bright as that of the Belshaw vein at Mount Diablo. It has a reddish-black color and crumbles easily when exposed to the air. The following section of the strata was taken with difficulty on account of faults and the many windings in the tunnel:

Starting at the top of the hoisting slope.	
Thin strata of slate, clay, and sandstone.....	160'
Blue-gray sandstone.....	20'
Base of slope.....	3'
Black sandstone soaked with bitumen.....	3'
Hard gray sandstone.....	28'
Very hard gray sandstone.....	5"
Poor coal.....	4"
Soft blue-gray sandstone.....	20'
Blue clay.....	5' 6"
Poor coal.....	3"
Blue clay.....	18'
Soft blue-gray sandstone or sand (emitting gas).....	10'
Hard cemented pebbles and shells.....	1'
Good coal (little vein).....	1'
Blue-gray clay.....	27'
Soft blue-gray sandstone.....	2'
Poor coal.....	2"
Blue-black clay.....	1' 6"
Soft crumbly coal.....	7"
Blue-black clay.....	2'
Gray clay.....	5' 6"
Black shale.....	7"
Coal (big vein).....	4' 6"
White sand.....	4'
Blue clay.....	

In the length of the gangway the strata differ considerably in thickness. At the face, sandstone lies above coal, replacing the clay of the section, and in places the shell cement above the "Little" vein is wanting, sandstone forming the roof. Steel "T" rails are used in the mine. The cars hold about 1,400 lbs., and are hoisted by a small double steam engine. The mine makes about 240 cu. ft. of water per hour, as stated above. A Cornish pump running eight hours per day keeps it dry. An old steam pump stands at the base of the incline, but it is not in use now. The company ships about 300 tons of coal per month, mostly to Fresno, where it sells at \$5 50 per ton. Freight costs \$1 50 per ton. A

branch railroad,  $2\frac{1}{2}$  miles long, runs from Coalinga to within one fourth of a mile of the mine, and the mine cars run by gravity to the bunkers; when empty they are hauled back by horse-power.

*Warthen Creek, Coal on.*—All along the south side of Warthen Creek, through the whole of T. 21 S., R. 13 E., croppings of coal are found, but beyond a little scratching no work has been done. On Hot Springs Creek, in Section 12 of the same township, Mr. Crump said he opened a coal mine several years ago and found two veins, one 3 and the other  $1\frac{1}{2}$  ft. thick. The sample of coal shown as coming from these veins is harder than any California coal that the writer has seen. The location is 9 miles from the end of the railroad at Alcalde, and it might pay to ship coal into the San Joaquin Valley. At Mud Springs, on the Old Vaughn place, Sec. 36, T. 20 S., R. 12 E., a cropping of carbonaceous matter crosses the gulch. The strike here is N.W. and S.E. and the dip probably  $80^{\circ}$ .

#### HUMBOLDT COUNTY.

*Alder Point.*—Near Eel P. O.; mentioned in our Xth Report, p. 207, but nothing of value exists here. The coal occurs in thin seams in much disturbed gray sandstone.

*Buck Mountain Creek.*—Two miles from its mouth is the next cropping, N.W. from the Ray ranch. It is said that an opening was made here and some coal taken out which proved to be of good quality. Float found in the creek below seems to confirm this statement. The writer did not succeed in finding the hole or the cropping, although he went far beyond the point where they were said to be. Recent landslides must have covered them up. About a mile below Garberville a place was shown near the water's edge in the river, where a few years ago coal of good luster and hardness cropped out several feet thick, but the river has washed in a lot of sand and gravel and covered up everything many feet deep.

*Garberville.*—In this vicinity the South Fork of Eel River winds its way through a heavy bed of unaltered yellow sandstone, intercalated with clay shale and beds of gray clay, belonging probably to the Tertiary age. The formation lies non-conformably upon the gray metamorphic sandstones. It has a dip of  $38^{\circ}$  N.E. and a strike N.W. Throughout the district lumps of bright black coal are found as float in the streams, and are collected and used for blacksmithing. The bulk of this float comes from pockets and irregular veins in the sandstone, and is the result of conversion into coal of a few or even a single tree at any one place. It resembles in appearance and composition the coal found in Round Valley.

*Harpst Mine.*—On Mad River, a short distance above the mouth of Boulder Creek, Mr. Harpst found some coal and made an open cut into the vein to prospect it. The vein is about 3 ft. thick and is composed of a number of thin seams of coal, alternating with serpentine (in this case metamorphic shales). The vein lies in serpentine and is twisted and warped parallel to the strata of that rock. What little there is of it is a soft, bright, greasy-looking coking coal, containing 45 per cent of ash, consisting principally of sulphate of lime. The coal is of no commercial value, but the occurrence of it in the serpentine is of great interest, in so far as it proves the sedimentary origin of the serpentine conclusively.

and may lead to the determination of its age, which at present is still an open question.

*Hydesville.*—Near here, on the sandbars of Van Duzen River, just above the mouth of Yager Creek, is a large amount of float coal. Somewhere above, a good-sized vein must be exposed to erosion by the river. The coal is a young lignite of good quality, resembling that from Poison Camp in general structure and appearance. It is darker in color when dry and is brighter when broken across the fiber. Although a much younger coal than that from Mount Diablo, for steam purposes it is fully equal if not superior. It makes a quick hot fire, does not contain much ash and does not crumble into dust. The cropping occurs probably not more than 4 miles from the end of the railroad at Hydesville, and the intervening country is inexpensive to build over. Should the coal vein be found to be of sufficient size to mine and the railroad extended to it, there is no reason why it would not pay to ship the coal to San Francisco.

*Preston Mine.*—Proceeding from the coast up Mad River, serpentines and metamorphic schists form the mountains on both sides as far as the village of Blue Lakes. Here Tertiary sandstone again appears, and extends up the river on the north side to a point a few miles beyond Boulder Creek, thence swinging to the north and leaving the river. Float coal equal in quality to that found in Van Duzen River, near Hydesville, can be gathered in many of the creeks flowing into Mad River from the north, and in Maple Creek croppings of the veins have been discovered and some prospecting done. A shaft in the creek bed is said to have been sunk to a depth of 70 ft., but no trace of it can be found. A small heap of much decomposed and impure crumbled coal lies on the bank of the creek, from which samples were taken. Only conflicting statements could be obtained from the men who worked in the shaft; they are not practical miners, and their estimates of thickness of the coal vary from 2 to 9 ft. Immediately below the shaft a bed of soft gray sandstone shows across the creek, with a strike of N. 20° W. and a dip nearly perpendicular. Up Maple Creek a distance of 500 ft., Crogan Creek comes in from the S.W., where large pieces of tough lignite of brown hue were found. Apparently, the vein crosses the creek close to its mouth, but the cropping did not show. A short distance beyond another small stream runs into Maple Creek from the same direction, and in it, 300 ft. from its mouth, a 4 in. vein crops out, lying in gray sandstones with a dip of 20° N.N.W. One thousand feet beyond this is a vein 6 in. thick, in blue clay, while 300 ft. farther a larger vein crosses the stream. It is a tough brown lignite of good quality; its thickness could not be determined. The piece forming the cropping extends clear across the creek, 10 ft., and is 2 ft. thick. It weighs possibly half a ton, and lies with a dip of 20° to the N.N.W. For a distance of 40 ft. above this, coal shows in patches in the bottom of the creek, and certainly one very large or several smaller veins must exist there. Wall rock is not exposed, but judging from the configuration of the surface it is clay or at least soft material.

Two miles down Maple Creek, on Mr. Fale's place, float coal was found in a small tributary, and a mile farther down, near the junction of the road with the creek on Marshe's ranch, coal shows in the bank of a little stream that flows into Mad River 1,000 ft. below the mouth of Maple Creek. The vein is 18 in. thick, and lies in blue clay, with a dip of 40°



W.S.W. In quality it is a dull, earthy brown coal, and when wet resembles somewhat the Ione coal.

*Ray Ranch.*—It is in T. 5 S., R. 4 E., 7 miles S.E. from Garberville, and on it coal crops out in a little creek which empties into the east branch of the South Fork of Eel River, about 1,000 ft. E. of Mrs. Ray's house. The creek has cut its way into the sandstone nearly at right angles to the strike of the strata, and three veins are exposed; another is said to exist, but is now covered up. They show a dip of  $36^{\circ}$  to the N.E. Below the coal lies a gray clay shale; 14 in. of coal; 12 ft. of the same shale; 3 ft. of coal; 8 ft. of shale;  $1\frac{1}{2}$  ft. of coal, and the whole is covered with yellowish clay mixed with sand. The coal having been exposed to the weather for years, looks very poor. It has weathered into thin laminæ of a dull slaty black color, which break up readily in the hand. Lumps of highly bituminous glistening black coal are found scattered through the mass. The value of these mines cannot be determined at present, or until opened in solid formation. The sample analyzed (see end of this chapter) was taken from the surface and contained a large percentage of impurities infiltrated from the muddy stream, which show in the ash.

#### MENDOCINO COUNTY.

In Mendocino County there are found three beds of lignite, which traverse the country in a N.W. direction, nearly parallel with the sea-coast and with each other. The most westerly bed crops out in many places immediately along the coast and is mentioned in our previous reports. It consists of one or more thin seams of excellent coal, varying in thickness from an inch to a foot. Nowhere, however, has coal been found in sufficient quantities to be of commercial value.

The second bed exists 12 to 25 miles from the coast. Croppings occur at Doolan Cañon and on Ackerman Creek, near Ukiah; in Walker Valley, 4 miles S. of Willits; at the head of Ten-Mile River, on the road to Westport, 2 miles S.W. of Cahto; on Mill Creek near Cole's Station, and farther north in Humboldt County on the Upper Mattole, and near Camp Grant on Eel River. Like the first bed it generally contains a good quality of coal; some of it will coke, but as far as known, the seams seldom exceed a few inches in thickness and are too thin to mine.

The third bed lies 15 to 20 miles still farther inland, and contains a vein of great thickness and value. It is exposed in Middle Eel River south of Round Valley. The existence of this coal has been known for many years, but the locality where it occurs lies in the very heart of the Coast Range, in a country cut up in every direction by rocky and crooked cañons thousands of feet deep and traversed by mountain ridges of great height and grandeur. Capital so far has not seen its way clear to build a railroad into this region, and communication with the rest of the State is limited to the pack mule and wagon. A railroad survey was made years ago from Ukiah to Eureka in Humboldt County, following the redwood belt on the South Fork of Eel River near the coast, and a branch was run down Outlet Creek to Eel River, and thence to the coal bed. Construction, however, was never commenced. The Fort Bragg Lumber Company is building a railroad from the coast to Willits, and it is expected that this line will be extended to the coal field. In the summer of 1894 it was engaged in making a survey for a railroad to Round Valley, via Eel River.



Many industries might be developed were proper transportation facilities provided. Yellow and sugar pine grow on the higher mountains, while spruce, madrone, and oak cover the hillsides. Tan-bark in inexhaustible quantities can be collected. Chromic iron and manganese ores of remarkable purity exist in several localities. Mr. Shimmin found both near his ranch at the head of Tomki Creek.

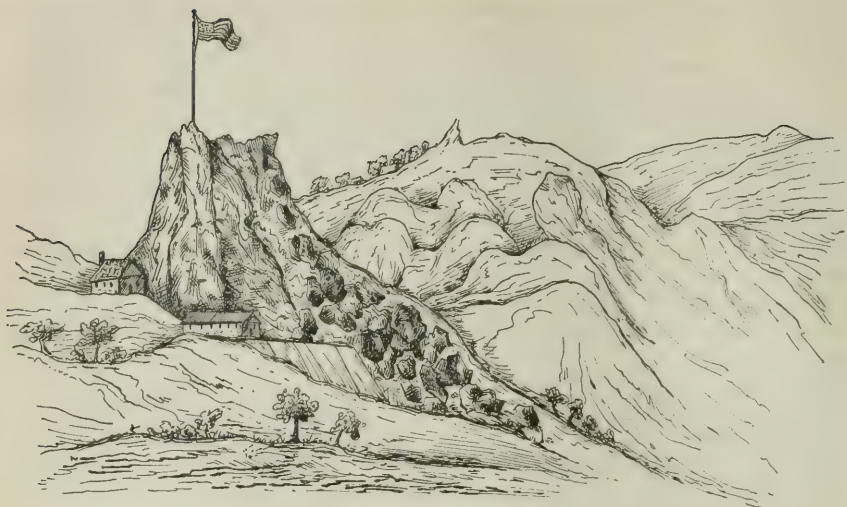
*Eel River Mine.*—The coal beds can be traced for many miles, but the only place where the vein has been prospected extensively is in the Middle Eel River, opposite the mouth of Salt Creek, in Sec. 1 or 2, T. 21 N., R. 13 W. The first discovery was made in the river just below where Salt Creek comes in. The vein here crops out across the river with a dip of  $31^{\circ}$  E. It shows a thickness of 14 ft., with a seam of whitish slate 3 to 6 in. thick near the middle. A section taken shows:

Top stratum not exposed.	
Blue clay shale, weathering into small fragments .....	26'
Coal of good quality and luster .....	5' 6"
Soft white slate, containing sulphate and carbonate of lime .....	3"
Coal of dull luster .....	8'
Sticky blue clay, containing minute shells .....	21'
Same clay, containing oyster shells .....	1'
Soft gray agglomerate, containing clay and fragments of serpentine and sandstone .....	5' 6"
Soft greenish metamorphic sandstone .....	30'
Serpentine beneath.	

About 1,000 ft. up the river there is a cliff 60 to 80 ft. high, of a very hard greenish metamorphic rock, and the strata seem to lie conformably upon the coal. Going north from this cropping half a mile, perhaps 300 ft. above the bottom of the river, several openings have been made. A tunnel, said to be 400 ft. long, is run in on the vein on a course of N.  $10^{\circ}$  E. About 50 ft. of this is still open; the rest is caved. The lagging prevents any study of the strata. Several tons of coal lie on the dump crumbled into fragments. Some 60 ft. above the mouth of the tunnel is an incline, 30 ft. deep, driven with the pitch of the vein, showing 7 ft. of coal, with coal for bottom and roof. Below the coal, or west of the openings, a hard gray metamorphic sandstone covers the ground, but of its thickness and position nothing could be seen. A few hundred feet east of these openings metamorphic rock occurs again in the shape of a perpendicular cliff 400 to 500 ft. high, forming quite a feature in the landscape. The rock is very hard, of a greenish color, and contains iron pyrite. It has not been satisfactorily determined whether this cliff is of sedimentary origin or not; although it seems to be stratified, it may prove to be an eruptive dike, in which case it will have cut off the coal vein at a point probably 500 ft. below the surface.

It is a feature to be noted, that here the coal exists in a heavy seam between the beds of rock highly metamorphosed without having undergone any notable change in structure or composition. It is to be expected, however, that as greater depth is reached, the result of metamorphism will be apparent, in so far that the coal will contain more fixed carbons and less volatile matter. In quality the coal is fair; it will crumble to some extent; iron is present in the shape of hematite; no pyrite was noticed. Union Lumber Company, of Fort Bragg, lessees.

Going southeasterly from the cropping in the river, the coal measures can be traced up Salt Creek. About a mile from the river the first cropping occurs. The underlying clay here is substituted in part by a bed of broken shells compacted into a rather hard rock of white color. The



Metamorphic Cliff on Eel River.

course of the vein is S. 35° E. Another mile up the creek takes us to some prospect holes which were sunk to trace the vein. Several other places show coal, and all traces disappear at the road from Carey Post Office to Rodeo Valley, where the coal measures are represented on the surface by a strong bed of blue clay full of broken oyster shells.

Going north from Eel River the croppings can be followed to nearly the top of the mountain, a distance of about 2 miles; beyond that the course of the vein is uncertain.

*Round Valley.*—In the hills and gulches of Round Valley coal is found as float, and it has been supposed that it came from croppings of the big Eel River vein, which must cross here somewhere. The float, however, is an entirely different coal in composition as well as occurrence. The Eel River vein is of the same age as the inclosing metamorphic rocks, Cretaceous, if not older; while the Round Valley coal occurs in a very short, gravelly, unaltered sandstone overlying the metamorphic strata non-conformably, and belonging to the middle or later Tertiary age. The old prospect holes are caved in and no cropping could be found in place; several residents report that there exists a good workable vein. The coal is a very bright, glistening black variety, with conchoidal fracture; it contains little ash and a high percentage of carbons; it does not crumble and stands transportation well. It is in every way a desirable and valuable coal.

*Thomas Mine.*—It is 3 miles S. of the mouth of Salt Creek, and is on the same vein as the Eel River mines, being the most southerly opening upon it. A tunnel, now caved, was run southwesterly 50 ft. entirely in coal. No walls are exposed, and it is reported that the vein is 11 ft. wide. A new tunnel to the east of the old one is in contemplation. W. P. Thomas, of Ukiah, owner.

#### MERCED COUNTY.

In 1893 a well was bored on the ranch of W. J. Hardwick, about 3 miles N.W. of Snelling. It is said that a stratum of several feet of coal, resembling the Ione coal, was passed through. Mr. H. C. Swain, of the

Merced gasworks, states that he examined a sample of this coal, and that its physical appearance resembled that of the Ione coal; that it burned readily in an open fire, and yielded an ash which in quantity and general appearance resembled the ash from a sample of Ione coal of similar size, which he burned for purpose of comparison.

## MONTEREY COUNTY.

*Priest Valley Coal Field* (See also Fresno County).—Coal lies under the northern half of Priest Valley and the veins extend far into Fresno and San Benito counties. Following the croppings west from the Drabble Mine in the latter county the veins appear again in the creek bed on Sec. 21 on Mr. Clayton's homestead. Here the creek has cut into the side of the low bluff, and the carbonaceous strata are exposed and show a thickness of about 300 ft. About a mile down the creek, near the corner between Secs. 21 and 17, the creek cuts them again. A section shows as follows:

Gray sandstone above.		
Blue shale .....	60'	
Clay stained with iron .....	12'	
Carbonaceous matter with thin seams of coal .....	15'	
Blue clay .....		5''
Decomposed coal .....	5'	
Gray soft sandstone with clay .....	2'	
Clay rock .....	10'	
Coal .....	3'	
The strike is N. 80° W., and the dip 40° N.E.		

Five feet above, another seam appeared, but its thickness could not be measured, as it was partly covered with earth. Some large pieces of nice bright coal which came out of that vein were found in the creek.

The next cropping occurs in Sec. 7 or 12 of the next township, but the hills here are covered too deeply with soil to trace them.

Another set of veins exist  $1\frac{1}{2}$  miles N.E., running parallel to the one just described, and have nearly the same strike and dip; in other words, they lie conformably upon the Drabble bed. The croppings can be traced through Secs. 14, 10, and 9, and probably farther N.W. as well as S.E. There are two veins of carbonaceous matter close together. The upper is 100 ft. thick, and has at least two good sized veins of coal; below this lies 50 ft. of gray sandstone, and then comes the lower vein, which is 50 ft. thick. No work has been done on these veins, and their value is a matter of uncertainty.

*Stone Cañon.*—This mine lies on the most southerly cropping in the Priest Valley coal field, and in the drainage of the Salinas River. See our VIIth and VIIIth Reports, pp. 172 and 403. Disagreement about the price of the land was the cause of work being suspended several years ago. This property is of importance, for the reason that the vein is very large, and that the coal is hard enough to stand handling. Lumps exposed on the dump to the weather for four years had crumbled but little. The croppings have been traced east to the head of Stone Cañon, and west about a mile beyond the lowest working. No doubt the coal extends many miles beyond these points, waiting for the prospectors to uncover it. Croppings have been found in many places in the cañons of the headwaters of Gaviota and San Lorenzo creeks, which are supposed to be of the same veins as those in Stone Cañon. No work has been done on them as far as could be learned, and they were not visited.



The coal measures in and around Priest Valley will be of great commercial value and importance in the future when made accessible by railroad facilities. A railroad 20 miles long from the present terminus, Alcalde, would tap the field on the east side of the summit, and should it be continued to Hollister or Kings City, short branches to the outlying mines would reach the entire field.

#### ORANGE COUNTY.

*Yoch Mine* is situated in Santiago Cañon, about 20 miles from Santa Ana. A vein 12 to 18 in. thick is being worked and the coal shipped to local points by wagon. It is said to give satisfaction.

There are several other prospects of coal in Santiago Cañon, one of which was unusually promising, but being located on railroad land the miners were compelled to stop operations. The workings were not accessible.

In the *Trabucco Cañon* small coal prospects have been discovered, but little work has been done on them. The veins are small. This coal field can be traced in an almost unbroken line around the northern end of the Santa Ana range to South Riverside, and thence on toward Elsinore, in Riverside County, where it reaches its greatest development.

That the coal seams thus far discovered in Orange County will ever become of any considerable commercial importance is extremely doubtful.

#### RIVERSIDE COUNTY.

The largest coal mine in operation in the southern part of the State is 6 miles W. of Elsinore. The vein is 3 to over 10 ft. in thickness, occurring in sandstones and sandy shales—rocks that are evidently of Tertiary age. It is a lignite and makes a very good heating coal, and is also used quite extensively for making steam in stationary boilers, but is too light for locomotive use. The mine has been opened over an area about 1,000 ft. square, and has produced a large quantity of coal. A remarkable fact in connection with this bed of coal is that diamond drill holes sunk in the foot-wall at the depth of 40 ft. encountered granite, and this underlying granite country and the metamorphic rocks of the vicinity a mile distant contain veins of gold-bearing quartz. Indeed, there is no reason to doubt that a vein of gold rock may not or does not exist directly beneath the bed of coal in question. The gold is faulted from 1 to 10 ft. in several places, but there has never been any trouble in finding the coal at each break.

The mine lies quite flat, dipping  $3^{\circ}$  to  $10^{\circ}$  into the hill. It has been opened by a tunnel starting in the foot-wall and running in on a level for some distance. A station has been cut out underground, from which point the main gangway has an up-grade of about  $10^{\circ}$ . Where the bed of coal is encountered a second station is cut and a large drum set up; from this point to the base of the incline there is a double track, the loaded car furnishing power to draw the empty one up. The system of mining is by excavating large chambers, pillars of nearly equal size being left to support the roof. A few posts and caps are employed. There have been remarkably few caves, considering the scant timbering. The mine is perfectly dry and free from fire damp. At one point a large fire of coal is kept burning on a grate, causing a strong up-cast draft.

## SAN BENITO COUNTY.

*Oat Cañon.*—In Oat Cañon, in Secs. 20, 21, and 28, T. 19 S., R. 11 E., carboniferous strata crop out, aggregating in thickness probably 300 ft. Some work has been done here, but has long since caved. One of the owners said that they had driven a tunnel 20 ft. into the shale and found a 5 ft. vein of coal, with a 3 in. seam of shale, but that the coal was air-slacked and unfit for use, although very bright and black. There are five veins of good coal besides this one; several are 2 ft. thick, but no work has been done on any of them. The dip is 40° E. of N. and the strike E. and W. Gray sandstone lies below as well as above.

## SAN LUIS OBISPO COUNTY.

*On the Piedra Blanca Grant.*—A small seam of coal has been discovered on this grant. It lies on the north side of Pico Creek, 4 miles from the ocean. The deposit is not over 15 in. thick, and probably will have no commercial value.

## SHASTA COUNTY.

*Cow Creek.*—Near here, in Sec. 12, T. 33 N., R. 2 W., there is an extensive outcrop of coal. A number of seams, with thin clay layers between, about 20 ft. thick altogether, have been exposed in a shaft; the thickest of the seams is about 2½ ft.; one is 15 in., and others from that down to a few inches. The coal is said to be of good quality, though not entirely free from pyrites. The roof is sandstone; the floor clay.

Near the Iles place, north of Little Cow Creek, coal seams are also exposed for quite a distance; these beds dip 5° to 10° E., and have not been worked.

## SISKIYOU COUNTY.

*Siskiyou Coal Mining Company's Mine.*—It is on Willow Creek, about 10 miles N. of Yreka, 4 miles E. of Henley, on the S. P. R. R. The developments consist of a 400 ft. incline with an 80 ft. and a 100 ft. cross-cut. It is stated that the vein shows an average thickness of 4 ft., about 30 in. of which is good coal. D. Horn, of Hornbrook, President.

## SONOMA COUNTY.

Several seams of coal, varying from 2 to 15 in. in thickness, crop out in the sandstone 8 miles S.E. of Cloverdale. It is said to be of a fair quality, burning with a good flame; the seams are not worked. A shaft has been sunk 20 ft. Owners unknown.

*Bennet's Claim.*—This is at the head of a gulch about one fourth of a mile from the beach, in the vicinity of Fort Ross, and has been idle for years. A shaft was sunk 80 ft. deep, from which it is reported that a good quality of coal was obtained but no continuous seams were found.

*Hauser's Claim.*—It is 8 miles E. of Stewart's Point. No work was being done, and little could be seen beyond some black shales.

*Pierson Mine.*—This is 5½ miles from Mark West Creek, on the ranch of Mr. Wrighton. A shaft has been sunk 150 ft., and a bore-hole continued from the bottom for 50 ft., which is reported to have cut through

three seams, respectively 2 in., 1 ft., and 4 ft. thick. One fourth of a mile south from the shaft are several tunnels, mostly caved in. The uppermost one runs 75 ft. northwesterly to a seam of coal and black shale from 1 to 3 ft. thick. No coal has been shipped from here, and the mine is closed down.

#### TRINITY COUNTY.

*Hay Fork Valley Coal Field.*—Hay Fork Valley is an opening in the mountains at the confluence of Big Creek and Hay Fork. It contains nearly 8 square miles of arable land, partly under ditch. Near the village of Hay Fork, coal crops out in the bed of the river at two points. The upper cropping is found a mile below town, and contains two veins of coal, each 2 ft. thick. The dip is  $28^{\circ}$  S.E. The coal is much decomposed, having weathered into thin laminæ, and no opinion of its quality could be formed. A large log of hard lignite, containing fossil rosin, was noticed in the mass. The lower cropping lies 2 miles below town, also in the river bed, and is of more importance; the section shows a dip of  $55^{\circ}$  S.E.

Gray sandstone on top.	
Coal .....	5'
Gray sandstone .....	30'
Coal .....	1'
Gray sandstone .....	40'
Coal .....	6'
Gray sandstone in bottom.	

The large lower vein is poorly exposed, and the coal dirty and mixed with mud from the river. The upper vein consists entirely of a black, tough lignite of good quality. In the hills north of town the veins crop out again, but the exposure being incomplete, nothing regarding dip, thickness, or associations could be learned. The Hay Fork coal field is more valuable than the one in Hyampom Valley, partly because it is nearer to the railroad, and partly because the upper vein in the lower bed contains true lignite—a substance that will stand transportation, and make a valuable addition to the fuel supply of the Sacramento Valley. Mining could be done at little expense, owing to the clean sandstone roof and foot-wall. No bone or clay was noticed.

*Hyampom Valley* is at the foot of South Fork Mountain, at the mouth of the Hay Fork of Trinity River. A bed of carboniferous shale crosses the valley near the middle, and croppings of coal are found in the river and on the hillsides. The best exposure occurs in the bed of the river in front of the post office, where 10 ft. or more of coal crops out. What the foot-wall is cannot be seen. Above the coal lies 6 in. of rather hard, blue slate; 34 ft. of soft brown shale; 1 ft. of gray sandstone; 22 ft. of the same brown shale, and next gravel and soil to the surface. The dip is  $21^{\circ}$  E., but changes within a short distance to nearly horizontal. Following the course of the vein to the N.E. into the mountains between Hay Fork and South Fork the coal is burned out, only small patches here and there having escaped the fire. In the foothills on the south side of the river, at the base of South Fork Mountain, the vein is partially exposed. It shows below the surface soil:

Coal .....	3'	
Yellow shale .....		6"
Coal .....	3'	6"
Yellow shale .....		1'
Coal not wholly exposed.		



The dip is 15° S.W. Both croppings resemble the Ione coal in texture and luster, although in quality the one in the river is decidedly better. Two miles up Trinity River from the post office some parties had sunk a shaft, which is now caved. The cropping shows about 8 ft. of coal, dipping at a high angle to the W. It shows the effect of the squeezing it received during the tilting of the beds, in its brighter color and firmer texture. A short distance up the river the accompanying shales are exposed, lying next to a dike of diorite and baked into a hard rock. Two miles up Hay Fork a bed of cemented gravel 200 ft. thick forms the bank on the south side, and some of the harder strata crop as reefs across the river on a strike of S. 20° W. and a dip of 25° N.W. Below that lies blue clay shale 250 ft. thick, and in it occur a few thin seams of coal. Beyond the shale a very hard quartzose metamorphic rock appears, and of this material the mass of mountains farther east is composed.

The Hyampom Valley coal field extends undoubtedly over a great area, and as the veins are large and easily tapped, mining could be conducted at a minimum cost. What the value of the coal might prove to be from a commercial standpoint cannot be estimated until some underground developments have been made, but it is probable that it will stand handling much better than the Mount Diablo coal, and at least equal it in contained carbons. The mountains are covered with sugar pine, and taking the timber and the coal together as an inducement, no doubt capital can be prevailed upon to build a railroad into this region, with reasonable certainty of a handsome return on the investment.

*Poison Camp.*—The metamorphic rocks here are covered by a bed of very soft sandstone and sand of quite recent origin, and in this formation coal occurs, cropping out in Secs. 22 and 15, T. 2 S., R. 6 E., H. B. M. No work has been done on it. The vein is 3 ft. thick; strike N. and S., with a dip of 24° E. Another vein is said to lie above this one, and a cropping was pointed out a little higher up the hill. It proved to be the same vein, however, the dip and the contour of the hill accounting for the seemingly higher position. Immediately below the coal lies white clay 6 in. thick, and below that a very fine grayish-white sand. Above the coal lies fine white sand mixed with clay. The coal is a very young, true lignite, still showing plainly the structure of wood. It is tough and hard, and resembles ebony wood. Its color is a dull brown-black when split parallel to the fiber, and glistening black when broken across the fiber. After thoroughly drying, the color becomes somewhat lighter and the coal cracks. Bunches of bark are seen in the cropping, having a light red color and being hardly changed. Some pieces will float on water. Analysis shows the coal to be good, as it runs high in carbon and exceptionally low in ash; but the sand roof, if it does not change to a harder sandstone on driving under the hill, will make mining for profit almost impossible.

## ANALYSES OF CALIFORNIA COALS.

Locality.	Color of Powder.	Color of Ash.	Coking Qualities.	Water	Volatile Matter	Fixed Carbon	Ash	Authority.
<i>Priest Valley</i> — Drabble Mine—Upper tunnel, upper vein	Glistening black, brown tinge.	Reddish white.	None	11.25	38.25	38.50	12.00	Mathyas.
Lower tunnel, upper vein	Glistening black, brown tinge.	Dirty white.	None	13.25	33.90	38.60	14.25	Mathyas.
Upper tunnel, lower vein	Glistening black	Light red	None	13.25	37.65	36.60	12.50	Mathyas.
Lower tunnel, lower vein	Glistening black	Light red	None	13.00	37.25	31.50	13.25	Mathyas.
Stone Cañon Mine—From dump	Glistening black, brown tinge.	Reddish	Sticks together.	5.25	39.75	49.25	5.75	Mathyas.
<i>Coalinga</i> — San Joaquin Mine—Little vein	Glistening black, brown tinge.	Reddish	None	12.00	37.75	39.75	10.50	Mathyas.
Big vein	Glistening black, brown tinge.	White	None	11.25	40.25	31.25	17.25	Mathyas.
California Mine—Little vein	Glistening black, brown tinge.	White	None	13.25	41.75	35.00	10.00	Mathyas.
1,000 ft. in.	Glistening black, brown tinge.	White	None	11.25	48.50	31.40	8.85	Dr. W. D. Johnston.
<i>Mount Diablo</i> — Central Mine—Belshaw vein	Glistening black, brown tinge.	Red	None	13.00	36.00	48.00	3.00	Mathyas.
Clark vein	Black	Black	None	13.47	40.36	40.68	5.52	Whitney.
Black Diamond vein	Black	Black	None	14.69	33.89	46.85	4.58	Whitney.
<i>Walker Valley</i> — Shimmin's Prospect	Glistening brown	Reddish	Soft coke.	0.50	17.50	22.00	60.00	Mathyas.
<i>Middle Fork Eel River</i> — Main tunnel	Glistening black, brown tinge.	White	None	8.00	39.25	46.25	6.50	Mathyas.
Incline, 20 ft. down, cropping in river	Glistening black, brown tinge.	Reddish white.	None	7.50	17.75	47.75	27.00	Mathyas.
Top streak	Glistening black, brown tinge.	Reddish white.	None	6.75	40.00	47.50	5.75	Mathyas.
Bottom streak	Glistening black, brown tinge.	Reddish white.	None	6.25	31.50	46.25	16.00	Mathyas.
<i>Round Valley</i> — Float	Glistening black, brown tinge.	Red	Sticks together.	8.00	48.00	40.75	3.25	Mathyas.
<i>Mill Creek</i> — Mad River	Glistening black	Light red	None.	10.25	44.75	41.50	4.00	Mathyas.
Cropping on Marsh's place	Dull brown	Light red.	None	10.25	45.00	29.50	15.75	Mathyas.
Harpst Mine.	Glistening brown	Reddish white.	Hard coke	5.50	21.75	28.75	45.00	Mathyas.

<i>Mayle Creek</i> — Cropping in gulch above Crogan Gulch.....	Dull brown.....	Reddish white.....	None.....	14.25.....	53.75.....	29.50.....	2.75.....	Mathyas.....
Cropping in Crogan Gulch.....	Dull brown.....	Reddish white.....	None.....	14.00.....	49.80.....	32.95.....	3.25.....	Mathyas.....
Preston Mine.....	Dull brown.....	Gray.....	None.....	12.25.....	50.75.....	31.00.....	6.00.....	Mathyas.....
<i>Poison Camp</i> — Cropping.....	Glistening brown.....	Light red.....	None.....	9.50.....	41.00.....	48.40.....	1.10.....	Mathyas.....
<i>Lancha Plana</i> — Orr Mine.....	Dull brown.....	White.....	None.....	7.50.....	47.75.....	20.50.....	24.25.....	Mathyas.....
<i>Garberville</i> — Float from Buck M'tain Gulch.....	Glistening black.....	Reddish white.....	Soft coke.....	7.60.....	46.90.....	43.25.....	2.25.....	Mathyas.....
Cropping near Mrs. Ray's house.....	Dull brown.....	Reddish white.....	None.....	10.10.....	51.80.....	31.00.....	7.10.....	Mathyas.....
<i>Hwydstille</i> — Van Duzen River float.....	Dull reddish brown.....	Reddish white.....	None.....	8.75.....	51.50.....	35.50.....	4.25.....	Mathyas.....
<i>Hampden Valley</i> — Shaft 2 miles above post office.....	Dull black.....	Red.....	None.....	12.25.....	42.55.....	41.60.....	3.60.....	Mathyas.....
Cropping on west side of river.....	Glistening black, brown tinge.....	Reddish white.....	None.....	10.50.....	38.65.....	24.15.....	26.70.....	Mathyas.....
Cropping in river.....	Glistening black, brown tinge.....	Reddish white.....	None.....	11.30.....	40.50.....	39.70.....	8.50.....	Mathyas.....
<i>Hay Fork Valley</i> — Lower bed, lower vein.....	Dull slate.....	Red.....	None.....	9.10.....	34.25.....	19.15.....	39.50.....	Mathyas.....
Lower bed, upper vein.....	Dull brown.....	Red.....	None.....	11.25.....	47.00.....	38.25.....	3.50.....	Mathyas.....
Cropping in hills.....	Dull brown.....	White.....	None.....	14.00.....	39.20.....	31.05.....	15.75.....	Mathyas.....
Upper bed, containing rosin.....	Dull brown.....	Light red.....	None.....	10.10.....	51.80.....	31.00.....	7.10.....	Mathyas.....
<i>Eel River</i> — East of Covelo.....	Glistening brown.....	Reddish white.....	Hard coke.....	2.00.....	15.50.....	25.25.....	57.25.....	Mathyas.....
<i>Corral Hollow</i> — Main tunnel.....	.....	.....	None.....	16.00.....	39.00.....	36.00.....	11.00.....	Mathyas.....
Shaft.....	.....	.....	None.....	17.00.....	38.00.....	37.00.....	8.00.....	Mathyas.....
Shaft cannon coal.....	.....	.....	Sticks together.....	6.00.....	57.00.....	24.00.....	13.00.....	Mathyas.....
<i>Iron</i> — Newman ranch.....	Dull yellow brown.....	Blue gray.....	None.....	15.00.....	37.75.....	38.50.....	8.75.....	Dr. W. D. Johnston.....
Mine No. 3—Sample No. 1.....	Glistening black, brown tinge.....	Yellow gray.....	None.....	7.00.....	33.35.....	11.85.....	47.80.....	Mathyas.....
Sample No. 2.....	Dull reddish brown.....	Gray.....	None.....	14.00.....	42.40.....	34.35.....	9.25.....	Mathyas.....
Sample No. 3.....	Dull dark slate.....	Dirty white.....	None.....	12.65.....	41.60.....	28.00.....	17.75.....	Mathyas.....
Sample No. 4.....	.....	.....	.....	12.60.....	40.60.....	25.55.....	20.25.....	Mathyas.....
<i>Esmeralda</i> — Robinson & Rawlins Mine.....	.....	.....	.....	15.50.....	40.00.....	29.50.....	15.00.....	Dr. W. D. Johnston.....
Dolbeer & Holt M'e—Poorest coal.....	.....	.....	.....	9.00.....	38.50.....	34.25.....	19.25.....	Dr. W. D. Johnston.....
Best coal.....	.....	.....	.....	15.40.....	43.60.....	27.90.....	13.10.....	Dr. W. D. Johnston.....
Cheney Mine.....	.....	.....	.....	19.00.....	46.50.....	21.90.....	12.60.....	Dr. W. D. Johnston.....
<i>Seattle</i> — Nauvau.....	.....	.....	.....	5.00.....	40.00.....	50.00.....	5.00.....	Symington.....
Coos Bay.....	.....	.....	.....	2.98.....	32.16.....	46.31.....	18.55.....	Whitney.....
<i>Rock Springs</i> — .....	.....	.....	.....	17.00.....	36.00.....	35.00.....	12.00.....	Symington.....
.....	.....	.....	.....	6.25.....	31.75.....	52.45.....	9.55.....	Mees.....



## COPPER.

Copper ore is found in many counties of California, but is only utilized in a few. The copper product of the State fell off materially in 1893 from that of previous years, owing to the fact that the largest company operating, the Union of Copperopolis, while it continued mining, did not smelt any of its ores.

## CALAVERAS COUNTY.

The copper mining industry in this county has for many years been an important one, though since the summer of 1893 comparatively little has been done in Copperopolis and Campo Seco. The district and mines have been fully described heretofore. See our IVth, VIIIth, and XIth Reports, pp. 148, 151 to 156, and 167.

*Campo Seco (Penn Chemical Works) Mine.*—It is  $1\frac{1}{2}$  miles N.W. of Campo Seco. See our VIIIth Report, p. 152. Penn Chemical Works of San Francisco, owners; Solon Pattee, Secretary.

*Hecla (Copper Hill) Mine.*—It joins the Campo Seco Mine on the north. See our VIIIth Report, p. 156.

*San Francisco Mine.*—It joins the Campo Seco on the south. See our VIIIth Report, p. 156.

*Union-Keystone Mine.*—It is at Copperopolis, and is the largest mine in the district. See our VIIIth Report, p. 150. Agassiz-Shaw Co., of Boston, Mass., owners.

## FRESNO COUNTY.

*Copper King Mine.*—This is in Sec. 3, T. 12 S., R. 23 E. Developments consist of a 25 ft. shaft, a 40 ft. drift, a 140 ft. tunnel, and open cuts. The workings are partly filled with water. The vein is said to show a width of from 4 to 15 ft. In June, 1894, there was a large amount of ore on the dump, which appears to be chiefly decomposed copper pyrites, with some oxide and carbonate of copper. The country rock appears to be a mica slate passing into gneiss.

*Acres Mine.*—This is situated in Big Dry Creek Mining District.

Extensive copper leads are said to exist near the headwaters of Kings River.

## HUMBOLDT COUNTY.

*Red Cap Creek Mine.*—On the high precipitous ridge between Red Cap and Roise creeks, a great deal of money has been spent in underground prospecting for copper. Large pieces of float, native copper, and bornite are frequently found in Red Cap Creek and the neighboring country, and have attracted the prospectors to look for a vein of similar ore, but so far all attempts have been futile. The ridge between the two creeks rises perhaps 2,000 ft. above them, and is very steep. Slides, many acres in extent, can be noticed on both sides of the trail. The country rock is a soft slick serpentine, cut through near the summit by a heavy dike of a very hard eruptive rock, probably diorite. Copper float has been found throughout the slide material and in such shape as to lead to the belief that the ore occurs, not in a regular vein, but rather in bunches, as pockets in the serpentine. Although much money has been spent here, the work has been done without any system and does not

demonstrate the existence or absence of a vein of ore. John Daggett, of San Francisco, owner.

## MENDOCINO COUNTY.

*Native Copper Mine.*—It is situated on top of a spur about a mile S.W. from the cabin in Lost Valley. A shallow opening discloses a stratum of serpentine about 3 ft. thick, impregnated with small particles of metallic copper and copper minerals. The strike is E. and W. and the dip nearly vertical. The wall rock consists of the same serpentine, but is barren of copper. C. H. Staut, of Ukiah, owner.

*Red Buck Mine.*—This is a continuation of the Salinas, and contains some old abandoned workings on the same vein. In the bottom of a gulch a tunnel runs in 35 ft., and at its end a shaft is sunk about 50 ft.

*Salinas Mine.*—It lies on top of a spur  $1\frac{1}{2}$  miles S.E. from Lost Valley. A shallow opening does not disclose the thickness of the vein. The strike is N.W. and the dip  $65^{\circ}$  N.E. The ore is sulphide and is said to carry nickel. The walls are soft, decomposing serpentine. Dr. G. W. Staut, of Ukiah, owner.

*Thomas Mine.*—It is on Bratt Ridge, forming the southern rim of Eden Valley, 55 miles N. of Ukiah. The opening made several years ago is caved, and nothing could be seen of the vein; there are several hundred pounds of ore, rich in copper sulphurets, on the dump. It is to be reopened soon. W. T. Thomas, of Ukiah, owner.

## NEVADA COUNTY.

The same counties that are known as belonging to the auriferous belt of California may be considered as those containing copper ores. Along the entire west side of the Mother Lode belt, developments of copper ores are continually met with, and for the most part, under very favorable conditions for working, being mainly at an altitude which permits of operations being carried on the year round in the open air, and in a locality well supplied with water power and timber.

*Golden Eagle Consolidated.*—This property is  $2\frac{1}{2}$  miles N. from Spenceville. The ores contain with the copper an appreciable amount of gold, the copper being almost entirely in a sulphide condition.

*Imperial Paint and Copper Company.*—These works are in Secs. 35 and 26, T. 15 N., R. 6 E., at Spenceville. Fifteen men are employed. The company hold 220 acres of land. The ore workings consist of a pit, N.W. and S.E., along the course of the vein, 100 ft. deep, 200 ft. long, and about 100 ft. wide, from the bottom of which a drift has been extended on the ore body. In this opening stands about 40 ft. of leaching-water, which, when sufficiently strong, is hoisted out in iron buckets lined with tar and passed through a series of sluices filled with old scrap iron. Above the opening on the hillside is a dump, formed from the material taken out of this hole, placed over tar-coated sheets, estimated to consist of 150,000 tons. This mass has been decomposing, subject to the weather, for over twenty years, during which time the almost solid pieces of iron and copper sulphides have been oxidized and decomposed. The ore seems to form in the slate in large kidneys. Water brought from Dry Creek through 2 miles of ditch is sprayed over the entire heap, washing out the finely divided ore and copper salts. This leach is collected at the lower end of the pile and conveyed to four settling tanks, where the

floating parts are settled, shoveled out, and dried; this goes to make up the "paints." The leach passing clear out of these vats is directed through a long line of 2 ft. sluices, set at a low angle, and filled with scrap iron, on which the cement copper precipitates. This product is shipped to San Francisco to the chemical works for the production of bluestone. About \$2,000 per month is realized from this source.

The "paint," after being shoveled out on a platform and dried, is conveyed in cars to the paint mills, where it is passed through a chute that conveys it through rollers; elevators then convey it above a 30 ft. reverberatory furnace with step hearth and five work doors, where three or four charges, of one ton each, are roasted per day, with wood for fuel. The roasted paint is dropped through an opening in the hearth-bottom next the fireplace and spread evenly on an iron platform to cool, when it is passed through a chute under millstones until ground sufficiently fine, when it is again elevated, sifted, and filled into wooden barrels with the help of a patented packing machine. From 25 to 30 bbls., containing from 300 to 400 lbs. per barrel, are produced per day at present. A 50 horse-power engine is required for motive power. A cooperage is to be added. Fifteen men in all are employed around the works. The waste water leaving the works empties into Dry Creek, but is unfit for use. See our Xth Report, p. 392; also XIth Report, p. 313.

#### ORANGE COUNTY.

Small copper "prospects" have been discovered, and developed somewhat, on the high hills lying north of Trabucco Cañon, 25 miles E. of Santa Ana. They are apparently of no importance. The ore, while rich, occurs only in small pockets.

#### PLUMAS COUNTY.

A series of copper-bearing veins can be traced across the eastern side of the county. At various points they have been exploited for copper until the price of that metal declined. Later some of them continued active, on account of a paying quantity of gold and silver being carried in the ore. At present they are nearly all being held by assessment work, awaiting a more prosperous future for copper.

*Cosmopolitan Mine.*—This is on the north side of Genesee Valley, and carries large quantities of sulphuret ores. A tunnel was driven many years ago to cut the vein, but on account of the extreme hardness of the rock, progress was slow and the expense too great at the present prices of copper; hence, the claim has been idle for a number of years.

*Engel Mines.*—These properties (for there are three distinct claims, designated as No. 1, 2, and 3) are situated 16 miles N.E. from Taylorville, up the north arm of Indian Valley, on the Clarke trail in Union township. The first of these claims is on the left side of Light's Cañon, near the Engel ranch, on the road from Indian Valley to Honey Lake Valley across the Diamond Mountain range, and shows a large amount of "peacock" copper ore, carrying a large percentage of zinc and some iron. It is in the direct course of the copper and iron belt that passes through the country with a general N.E. course. This belt has an approximate length of 40 miles, with a width of about 4 miles, and is about 40 miles from railroad communication. The entire belt is well



supplied with water and timber. No. 2 and No. 3 claims are farther up Light's Cañon, near what is known as Clark's trail. Developments consist of tunnels run into the sidehill on ore; the longest of these is 425 ft., a second 180 ft., and a third 90 ft. These tunnels are about 55 ft. apart. The ore bodies are more in the nature of lenticular masses (kidneys), reaching a width of 60 ft. The ore is mostly low-grade sulphurets, with a little carbonate of copper. Idle, because of low price of copper.

*Pocahontas Mine.*—This claim is 20 miles from Susanville, 26 miles from Greenville, in Mountain Meadow district; half mile W. of the Plumas County line. The country gives plain evidence of eruptive action; rhyolite, basalt, and amygdaloidal rocks are in close proximity, and nearly all the springs carry copper in solution. The rock in which the copper bodies are found is largely epidote filled with small grains of native copper. The kidneys show large lumps of native copper, with red oxide and carbonates, and also native silver. Millerite (sulphide of nickel) was also found here.

#### SAN BERNARDINO COUNTY.

Along the Colorado River, south of the A. & P. R. R., and situated from 10 to 40 miles W. of that stream, in the Colorado Desert, are copper "prospects," on which little work has been done to prove their value, yet of which a great deal is heard from time to time.

In the region W. of Vanderbilt and N. of the New York Mountains are many veins and deposits containing copper ores.

In the Ord Mountain District, 12 miles S. of Daggett, are veins containing low-grade copper ores. These veins also contain gold. The copper occurs as silicate (chrysocolla) and carbonate (azurite and malachite). These veins are doubtless more valuable for the gold than the copper they contain.

*Amazon Mine.*—This is 5 miles E. of Oro Grande. A shaft 60 ft. deep with a drift 56 ft. long in hard rock has not uncovered, as was hoped, a rich body of ore. The work is in a diorite dike impregnated with small crystals of iron and copper sulphide. Near this shaft is a contact of limestone and an intrusive dike, along which considerable copper ore appears. This is the most promising place on the claim. Copper carbonate is found in small quantities in a score of places on the claim. Horace Eaton & Co., of Halleck P. O., owners.

*Copper World Mine.*—It is about 50 miles N.W. from Vanderbilt. The property has only superficial development. J. H. Boyd, of San Bernardino, owner.

*Tiptop Mine.*—It is in the Lava Beds District, 36 miles E. of Daggett. Fully described in our XIth Report, p. 354. W. U. Masters et al., of Pasadena, owners.

#### SHASTA COUNTY.

*Blue Jacket Mine.*—This claim, 1,500 by 600 ft., is in Sec. 25, T. 34 N., R. 4 W., 1 mile E. of United States Fishery on the McCloud River. This is a late discovery of copper and iron ore 4 ft. wide, between limestone and porphyry, with an N.E. and S.W. course, dipping about 30° N. Assays of the ore show 25 per cent of copper and traces of gold and silver. Three men have started development work.

*Cortez Mine.*—This is 9 miles S.W. of Round Mountain. The vein has an E. and W. course with a dip of  $45^{\circ}$  S., between porphyry and conglomerate walls, and varies in width from a seam to 4 ft. The ore carries principally copper and lead sulphides. A tunnel runs on the vein 173 ft.

*Peck Mine.*—This patented claim adjoins the Afterthought on North Cow Creek, Furnaceville. The ore deposits are near the contact of slate and porphyry. The mine is not worked, on account of the rebellious nature of the ores, which carry a high percentage of copper, lead, antimony, and zinc, and a little gold and silver.

#### SIERRA COUNTY.

*Depot Hill* is 5 miles N. of Camptonville. Above it and 300 ft. from the gravel diggings is a belt of serpentine, through which seams of copper ore, mostly carbonates, have been found, having a general N. and S. course. Considerable prospect work by shafts and tunnels was done here about twenty-seven years ago, but at present the property is unclaimed.

#### TULARE COUNTY.

*Copper Queen.*—This mine and the extensions thereof are situated above the snow line at the headwaters of the Kaweah River. It is said that the developments consist of open cuts; that the ledge is 150 ft. in width, and that the ore from it contains 18 per cent of copper. Also, that the vein stands nearly vertical, and has a strike of N.E. and S.W., and that one wall is slate and the other granitic rock.

*Mankins (Yokol) Mine.*—This mine is situated on Yokol Creek and about 9 miles E. of Exeter, on the Porterville branch of the S. P. R. R. The mineral-bearing portion of the ledge is said to be 4 ft. in width.

### GOLD.

#### AMADOR COUNTY.

The mines of this county have long since demonstrated the great depth of the veins on which they are situated, and the possibilities of deep mining. There are a dozen or more shafts which have attained a depth of more than 1,000 ft., and several of more than 2,000 feet. The Kennedy Mine furnishes an example of what may be possible elsewhere. Recently several new mining enterprises have been inaugurated, and some old ones have been revived. The mining industry in "Little Amador" was never in a more prosperous condition. Besides gold and silver, coal, clay, and marble are also among the mineral productions of the county.

*Alma Mine (Quartz).*—It is on the "Mother Lode," W. of Jackson. A heavy quartz cropping courses N.W. along the hill, to develop which a vertical shaft is being sunk nearly 400 ft. E. of the vein in the black slates. The vein has a black slate hanging- and diabase foot-wall. It is the intention of the company to sink 2,000 ft. on this vein. A large hoist was built in the fall of 1893, the shaft then being nearly 100 ft. deep. Alma Mining Company, of Jackson, owners.

*Albany Mine* (Quartz).—See New Albany.

*Amador Consolidated Mine* (Quartz).—This claim, comprising the Eureka and Badger mines, is on the "Mother Lode," S. of Sutter Creek. Described in our Xth Report, pp. 72 and 102. Mrs. N. Green, of New York, owner.

*Amador Mine* (Quartz).—See Original Amador.

*Amador Gold Mine* (Quartz).—It is  $1\frac{1}{4}$  miles S. of Jackson, and is fully described in our VIIIth and IXth Reports, pp. 88 and 102. J. H. Tibbetts, of Jackson, Superintendent.

*Amador Queen Mine* (Quartz).—It is 2 miles S. of Jackson on the "Mother Lode." See our VIIIth Report, p. 91. Idle. An interesting series of transition rock from diabase to talcose schist was obtained in this mine in 1893. They may be seen at the Bureau. W. N. Bardue, of 2443 Mission Street, San Francisco, owner.

*Argonaut (Pioneer) Mine* (Quartz).—It is on the "Mother Lode," and adjoins the Kennedy on the S.,  $\frac{3}{4}$  of a mile N. of Jackson. See our Xth Report, p. 111. Since then a corporation has been organized to thoroughly develop the mine, and a shaft commenced in the hanging-wall diabase, about 300 ft. from the croppings. The dip of the vein at the surface is considerably less than the angle at which the shaft is being sunk ( $63^\circ$ ), and it is calculated to cut the vein at great depth. It is thought that in depth the vein will assume a greater pitch, conforming to that of the shaft. These calculations are based on the developments of their neighbor, the Kennedy. The shaft has three compartments, the estimated cost of which is placed at \$35 per foot, and it is estimated 15 ft. can be sunk per week. In September, 1894, the shaft had reached a depth of 480 ft. Preparations have been made to carry the shaft to a depth of 2,000 ft. Argonaut Mining Company, of Jackson, owners.

*Astoria Mine* (Quartz).—See New Albany Mine.

*Badger Mine* (Quartz).—See Amador Consolidated.

*Bay State Mine* (Quartz).—This is 4 miles N. of Plymouth, and is briefly referred to in our XIth Report, p. 146. Since that time the cross-cut has been completed and drifts run N. and S. on the vein. So great was the quantity of water encountered that it was found necessary to construct concrete bulkheads in the drifts in the fall of 1893. In 1894, the shaft had been sunk to a depth of 400 ft., and excellent ore encountered. There are two veins in the mine, lying side by side. The foot-wall vein is banded and granulated and contains in the interstitial spaces carbonate of lime, which causes it to slack and crumble on exposure to the atmosphere. The hanging-wall is massive and firm, but low grade. A light-colored dike rock accompanies the vein. Bay State Mining Company, of Plymouth, owners.

*Belmont (Sutter Creek) Mine* (Quartz).—This is just N. of Sutter Creek, near the Amador Reduction Works. See our VIIIth and IXth Reports, pp. 73 and 143. In 1893 the hoist at the north shaft was removed to the New Albany Mine. It was said, however, that the Belmont shaft was to be continued down in 1894 with heavier hoisting and pumping machinery. Belmont Mining Company, of Sutter Creek, owners.

*Bellwether Mine* (Quartz).—It is N.E. of Jackson, on the outskirts of the town. See our Xth and XIth Reports, pp. 104 and 140. S. W. Bright, of Jackson, owner.

*Bunker Hill Mine* (Quartz).—See South Mayflower.



*Clinton Consolidated Mine* (Quartz).—It is at Wieland, 6 miles N.E. of Jackson. See our XIth Report, p. 142. This mine was in active operation during part of 1893, but in the fall of that year was closed down, and no reason given. Wieland Bros., of San Francisco, owners.

*Colorado and Kate Gray Mines* (Quartz).—These are two "prospects,"  $2\frac{1}{2}$  miles E. of Volcano. The veins are small, but the quartz is rich in gold. W. Q. Mason, of Volcano, owner.

*Downs Mine* (Quartz).—It is 2 miles E. of Volcano. See our VIth Report, p. 20. R. C. Downs, of Sutter Creek, owner.

*Doyle Mine* (Quartz).—It is on the "Mother Lode," between the Amador Queen and Amador Gold mines, 2 miles S. of Jackson. See our Xth Report, p. 107.

*Elephantine Mine* (Quartz).—See New Albany.

*Eureka Mine* (Quartz).—See Amador Consolidated.

*Evans Mine* (Quartz).—See Meek.

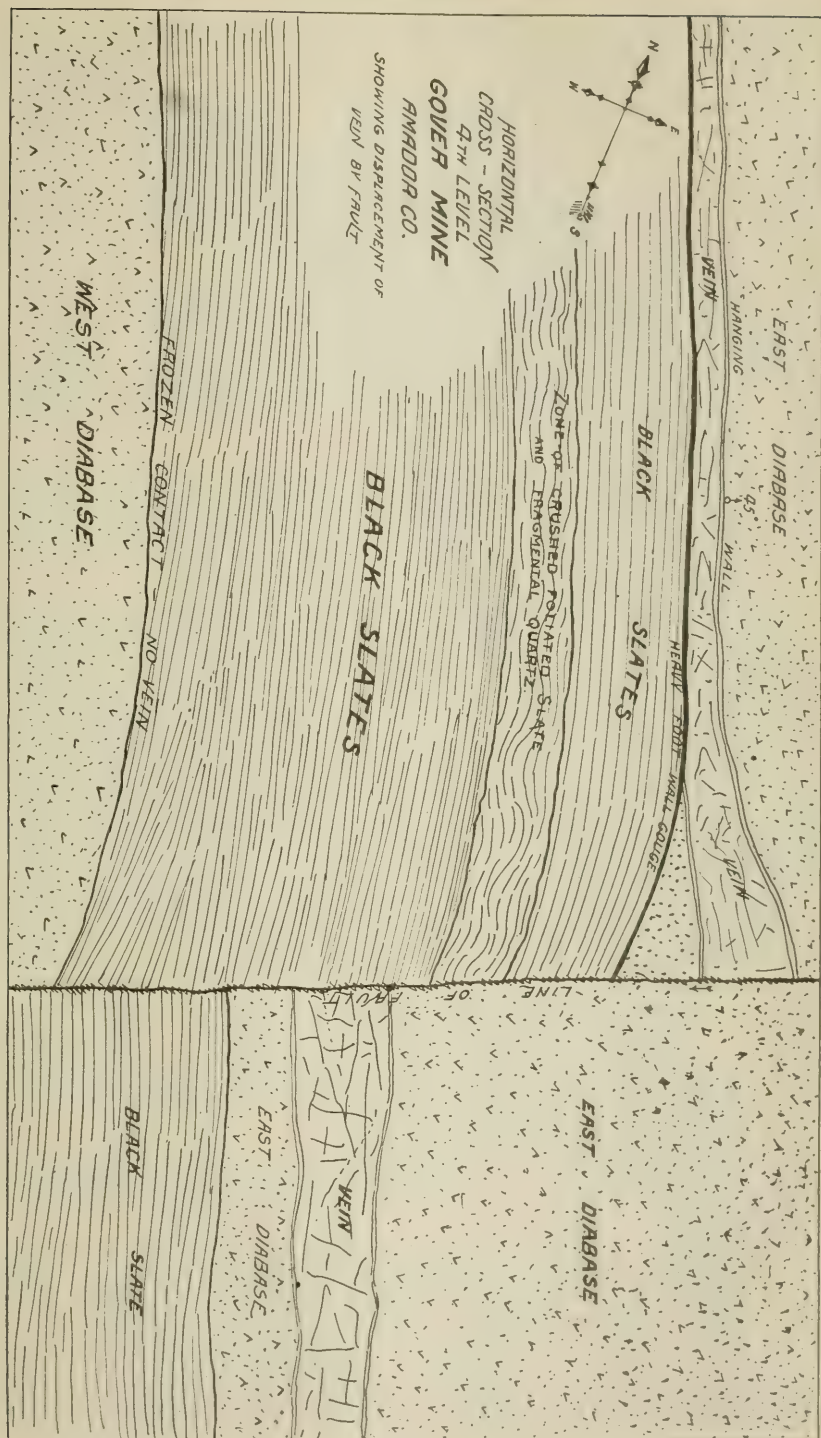
*Farrel Mine* (Quartz).—It is on the N. side of Mokelumne River, half a mile below Middle Bar. The mine has recently been equipped with a 5-stamp mill, and a force of men is at work on development. James Farrel, of Hardenburg, owner.

*Gold Mountain (Quartz Mountain) Mine* (Quartz).—This claim is  $1\frac{1}{2}$  miles N.E. of Amador City. Described in our Xth and XIth Reports, pp. 75 and 145. The property was in active operation in 1893. Gold Mountain Mining Company, of 325 Montgomery Street, San Francisco, owners.

*Gover Mine* (Quartz).—It is on the "Mother Lode," 2 miles N. of Amador City. See our VIIIth, IXth, and XIth Reports, pp. 53, 75, and 146. Important developments have recently been made in this mine. The depth of the mine in the fall of 1893 was 1,362 ft. to the bottom of the sump on the incline, or 1,000 ft. vertical. The south shaft is 700 ft. on the incline, or 525 ft. vertical. There are ten levels run from the main shaft at vertical distances of 100 ft. The longest drift south is 1,100 ft. and north 400 ft. from the shaft. It has two fissures, which at the surface lie between slate and altered diabase. The black slate reef separating these veins is 90 ft. broad at the surface, but widens in depth somewhat. The vein which lies on the east side of the slate, known as the hanging-wall vein, is well defined at the contact to a depth of about 775 ft., where it is pinched. The foot-wall vein continues at the contact for several hundred feet, and then stratifies. A cross-cut on the fourth level passes through a zone of crushed slate, quartz fragments, and veinlets similar to the zone in the Kennedy Mine, which marks the crossing of the vein from the west to the east diabase, and it is not unlikely that the same thing has occurred here. At the ninth level the foot-wall (slate) dropped back, and the shaft, which had followed a contact vein down from the eighth level, is continued on a large vein which has formed in the hanging-wall or east diabase. This ore body, which on the ninth and tenth levels is from 30 to 50 ft. wide, is the largest in the mine. It is more than 300 ft. high, and nearly as long, and has an average width of about 30 ft. Though of a low grade, it is said to be pay-rock. The mine has immense reserves in sight.

It is possible that the vein occurs at the contact of the east diabase and the slate in the lower levels. At this time no cross-cut has been run to determine this.

On the fourth level, 1,000 ft. south of the main shaft, the hanging-



wall vein has been found to leave the contact and strike out into the hanging-wall diabase. The vein is 5 to 6 ft. wide. A heavy gouge which has followed the foot-wall side of the vein continues at the contact, but the formation has been turned back from its course to the west. A drift was run on the gouge seam, which at some distance in encountered a fault. The hanging-wall diabase had been thrust west and was found abutting against the broken edges of the black slates. A cross-cut was driven 50 ft. west and has disclosed a mass of quartz in diabase, 12 ft. wide. It is probable that this is the continuation of the vein left in the main drift.

This section of the mine possesses unusual interest, being the first occurrence of a fault on the "Mother Lode" that has been noted.

Along the contacts both east and west the diabase in proximity to the veins has been sheared, compressed, and altered to slaty and schistose magnesian rocks (chloritic and talcose). Complete transitions from normal diabase to soft talcose schist may be seen at many points in the mine.

The large ore body in the lowest levels of the mine greatly resembles those of the Utica Mine at Angels, the quartz often including large and small masses of the altered diabase, which usually contains more or less auriferous iron sulphurets. Gover Mining Company, of Amador City, owners; A. B. Call, Superintendent.

*Hardenburgh Mine* (Quartz).—It is on the "Mother Lode,"  $3\frac{1}{2}$  miles S. of Jackson. See our Xth and XIth Reports, pp. 68, 106, and 139. The shaft is down 800 ft. in a heavy crevice, 15 to 20 ft. wide; the material consists of shattered and pulverized fragments of foliated black slate, a little quartz, and considerable clay, with occasional intrusions of altered dike rock. Masses of quartz, much shattered but still coherent, frequently occur, the outer surface being rounded and polished by pressure and attrition in the plane of the fissure, which, like most of the mines of this part of the lode, has been subjected to enormous movement and pressure during a long period of time. This phenomenon is observable in the Quaker City, Gwin, and the intermediate mines. The ground slips, swells, and runs, and requires most substantial timbering. Quartz has made its appearance at two places on the 800 ft. level, but it was very low grade. All energies were being devoted to prospecting. Hayward, Lane & Co., of 224 California Street, San Francisco, owners.

*Hollywood Mine* (Quartz).—See New Albany.

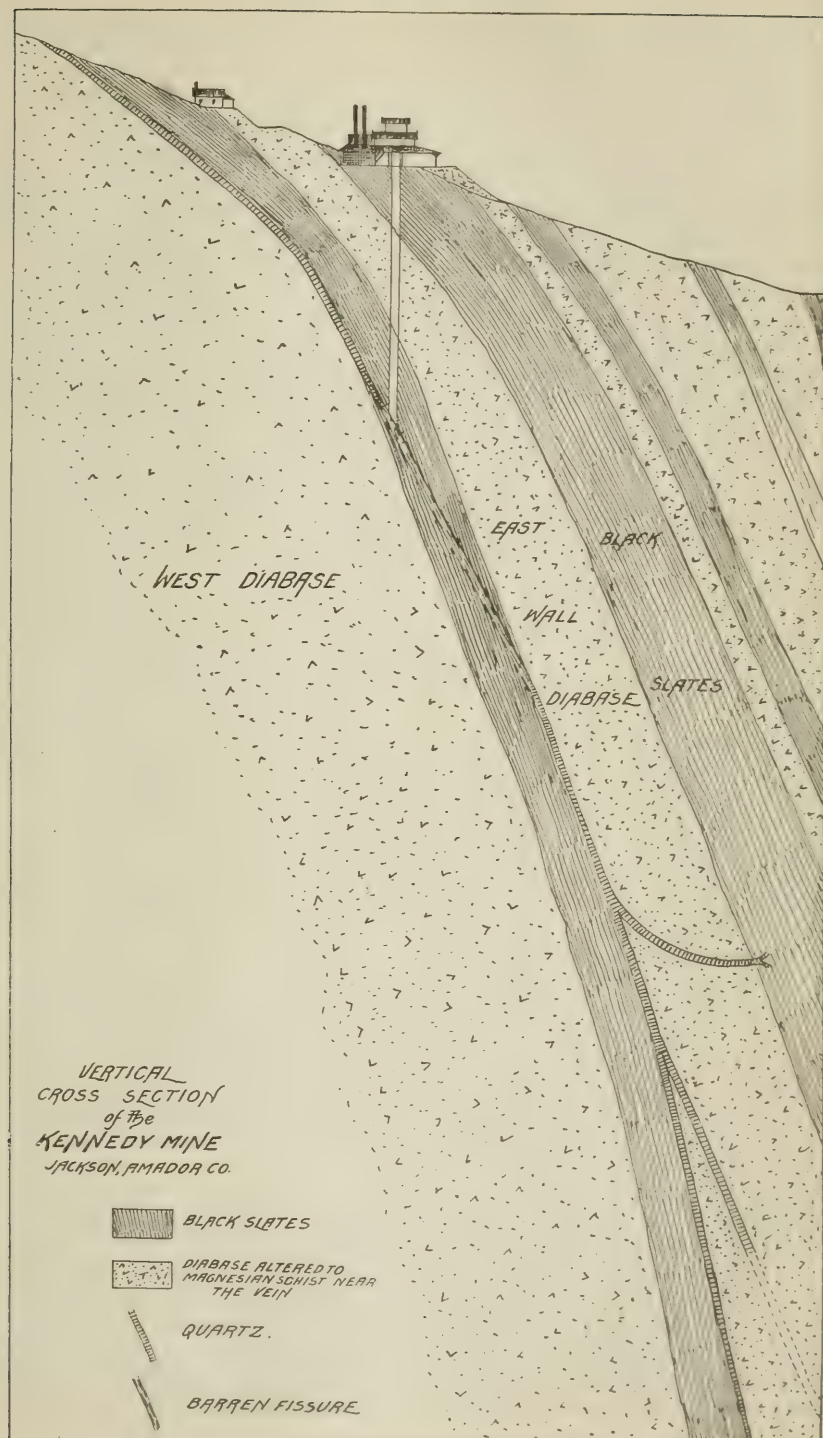
*Irma Mine* (Quartz).—This is at Pioneer, 16 miles N.E. of Jackson, in the granite region. In many respects it resembles the mines of West Point District, in Calaveras County. Irma Mining Company, of San Francisco, room 94, Crocker Building, owners.

*Kate Gray Mine* (Quartz).—See Colorado.

*Kelley Mine* (Quartz).—It is on the "Mother Lode," 4 miles S. of Jackson. Referred to in our Xth Report, p. 108. Henry Emerson, of Jackson, owner.

*Kennedy Mine* (Quartz).—This mine is on the "Mother Lode," one mile N. of Jackson. See our VIIIth, Xth, and XIth Reports, pp. 66, 70, 103, and 141. The south shaft has reached a depth of 2,000 ft. below the croppings on the incline, and 1,750 ft. vertically below the collar of the shaft. It is vertical for 376 ft., at which point it makes a bend conforming to the dip ( $66^\circ$ ) of the fissure. This abrupt bend in the shaft interferes with a rapid movement of the skips. To overcome the diffi-





culty a portion of the hanging-wall side is to be cut away, making a curve of greater radius, so that it may not be necessary to slow down when passing this point.

The geology of this mine is very interesting as an indication of possibilities in other mines where the quartz pinches, leaving only a barren crevice. A study of the surface shows several reefs or strips of black slate, intruded by dike-like masses of diabase. A cross-section at the south shaft (see cut), beginning with the foot-wall diabase of the vein, is as follows: Vein, 4 ft.; black slate, 80 ft.; east wall diabase, 200 ft.; black slate, 250 ft.; diabase, 30 ft.; black slate, 35 ft.; diabase, 300 ft.; black slate, 20 ft.; diabase, 200 ft. or more. Northward the strips of slate become narrower and pinch out, with a single exception, the broadest, which extends some distance into the diabase. One thousand feet N. of the south shaft, the black slate is only 25 ft. wide, while the surface diabase is more than 1,000 ft. The vein at the surface occurs at the contact of the west diabase and the black slates, which latter form the hanging-wall. This slate zone is 80 ft. in width, more or less. The vein follows the contact, striking N.  $20^{\circ}$  W. and dipping  $35^{\circ}$  to  $40^{\circ}$  to the E. at the surface. At about 400 ft. in depth the dip is about  $50^{\circ}$ , and at 700 ft.,  $60^{\circ}$ . Below this, the fissure has a pitch of  $65^{\circ}$  to  $70^{\circ}$ . The quartz continued to depths varying from 300 to 750 ft., the latter figure obtaining at the south shaft. Below these limits the fissure left the west diabase; the quartz became stratified, and nothing remained of the crevice excepting a zone of crushed and foliated black slate with fragments of quartz and small broken quartz seams. It was found in sinking that the fissure kept a fairly uniform pitch, while the inclosing rocks approached more nearly in dip to the perpendicular; the fissure crossing the slate and forming a contact with the slate and the east diabase, the latter now becoming the hanging-wall. The quartz reappeared at this contact on the 950 ft. level, and has continued to the bottom of the mine, the 1,750 ft. level. At several points the vein has branched, sending out shoots of quartz into the diabase hanging-wall. The distance on the vein from the croppings to the point where the south shaft intersects the vein is 800 ft. (The levels are presumed to represent the vertical depth.) The vein continued 750 ft. on the incline at the south shaft. The quartz re-formed on the east contact at the 950 ft. level. At the 1,250 ft. level a split occurs, a branch making off into the hanging-wall diabase. It took a low pitch, and it was thought it might lead to a bonanza in the east country rock. A cross-cut was driven east from the 1,350 ft. level and crossed the diabase, measuring 185 ft. horizontally. An upraise of a few feet encountered the vein, which was then followed east to the slate, where the quartz divided and a number of stringers and apparently the fissure came to an end. It has not been followed farther.

Again on the 1,650 ft. level, between the north and south shafts, and at a point where the contact vein is strong and well defined, the quartz strikes into the diabase of the hanging-wall. The vein maintains a nearly true course, while the slates and diabase are deflected to the west several degrees. A heavy foot-wall gouge usually accompanies this vein. This gouge occurs at the place referred to, but does not follow the quartz. It continues, however, at the contact of the slate and diabase. A similar occurrence was noted in the Gover Mine. It will be understood that this is not a split of the vein, but a branching off from the

contact on the strike of the vein. It is presumable that the movement which resulted in producing the gouge occurred subsequent to the formation of the vein, and the fracture followed the line of least resistance, viz.: the contact. The solid vein, which at the contact usually has a distinctly banded structure, has been split and the rock-masses subjected to movement resulting in highly polished surfaces. When the quartz is included entirely within the diabase it assumes a massive structure, the banded appearance of the contact vein disappearing entirely. The size of the vein and value of the quartz in the lowest workings show no deterioration. They are, practically speaking, similar to those above. Ores of both high and low grade are found on these lower levels. In short, the depth appears to form no criterion of the value of the quartz.

A section taken between the north and south shafts shows the quartz to continue from the surface to a depth of 300 ft., where it ends in numerous small stringers. The fissure continues as a zone of barren crushed slate. It crosses the slate belt to the east diabase, the quartz reappearing on the 1,200 ft. level, and continuing to the lowest workings. At 1,450 ft. an off-shoot was found making into the hanging-wall diabase, but at a much higher angle than that on the 1,250 ft. level. This branch on the 1,450 ft. level appears to maintain nearly the pitch of the vein above, the slates and diabase assuming a position nearer the perpendicular.

Opposite the north shaft a section shows the quartz to be continuous to a depth of 300 ft., where it ends. The conditions from that point downward are similar to those already described, the quartz re-forming at the 1,450 ft. level and continuing downward as a contact vein as far as explored.

A notable fact in the Kennedy vein is that the values are not always associated with quartz. In one portion of the fissure in the lower levels the crevice is destitute of quartz, the filling consisting of a mass of lustrous, scaly, foliated, black slate and black putty-like substance (pulverized slate), containing an abundance of auriferous iron sulphurets, for most part coarsely crystallized. This mass is from 2 to 4 ft. in width. It pays well, and is mined and sent to mill together with the more promising-looking quartz.

The idea that pay veins might lie in the hanging-wall country rock is losing favor; the cross-cut on the 1,350 ft. level having failed to develop anything of value. The shoot discovered some years ago in the west diabase has no apparent connection with the Kennedy vein.

This mine is substantially timbered, well managed, and is a model of its class; a fissure vein of moderate width and great depth. The recurrence of a well-defined and rich pay shoot of great continuity at such a great depth, after having pinched near the surface, leaving only a barren crevice in one place for more than 1,100 ft., should prove a great incentive to thoroughly explore veins of this type before abandoning them as being worked out. Kennedy Mining Company, of 404 Montgomery Street, San Francisco, owners; J. F. Parks, Superintendent.

*Keystone Mine (Quartz).*—It is in Amador City. See our VIth (Part II), VIIIth, and XIth Reports, pp. 16, 63, and 144. Since the last report the main shaft has reached a depth of 1,400 ft. (1,200 ft. vertical), with large reserves in sight. Its geological relations to the wall rocks are quite similar to those of the Kennedy. Keystone Consolidated Mining Company, of Amador City, owners.



*Lincoln Mine* (Quartz).—It is on the "Mother Lode," half a mile N. of Sutter Creek. See our VIIIth and Xth Reports, pp. 73, 72, and 100. E. C. Voorheis, of Sutter Creek, owner.

*Littlefield Mine* (Quartz).—See New Albany.

*Mahoney Mine* (Quartz).—This is just E. of the Lincoln and half a mile N. of Sutter Creek. See our VIIIth and Xth Reports, pp. 73 and 72. It was sold in July, 1894, to the Wildman Company, and its thorough development undertaken. Wildman Gold Mining Company, of Sutter Creek, owners.

*Mammoth Mine* (Quartz).—This is on the "Mother Lode," near the Mokelumne River, at Middle Bar. See our VIth (Part II), VIIIth, and Xth Reports, pp. 21, 93, 67, and 108. W. E. Nevills, of Jamestown, Tuolumne County, owner.

*Mayflower Mine* (Quartz).—This is a mile N. of Amador City, and joins the Old Bunker Hill, now called the South Mayflower Mine. A new shaft is being sunk quite a distance back of the vein in the foot-wall. A long drain tunnel is also being driven in from the base of the hill to connect with the shaft at a depth of 250 ft. Two prospecting shafts are also being sunk on the vein. Mayflower Gold Mining Company, of San Francisco, room 165, Crocker Building, owners.

*Meek (Evans) Mine* (Quartz).—It is S. of the Zeila Mine and half a mile from Jackson. Several shallow prospecting shafts constitute the development. Ellis Evans & Co., of Jackson, owners.

*Middle Bar Mine* (Quartz).—See New Albany.

*Moore Mine* (Quartz).—It is a short distance S. of Jackson, on the "Mother Lode." See our VIth (Part II) and VIIIth Reports, pp. 20 and 84.

*New Albany Consolidated Company's Mines* (Quartz).—They comprise the Albany, Middle Bar, Astoria, Hollywood, Elephantine, and Littlefield. A hoist was built on the Middle Bar claim in the fall of 1893 and active operations commenced. A tunnel was also run into the Albany Mine on the opposite side of the gulch from the Hardenburgh. As yet these mines, which are on the "Mother Lode," are only in the prospective stage. J. H. Tibbetts, of Jackson, Superintendent.

*New London Mine* (Quartz).—This property is half a mile S. of Plymouth, and is described in our VIIIth and Xth Reports, pp. 49 and 117. In 1894 the mine is being rehabilitated by an English company.

*New York Mine* (Quartz).—It is 3 miles W. from Jackson. See our Xth and XIth Reports, pp. 123 and 140.

*North Star Mine* (Quartz).—This is 2 miles S. of Amador City, on the "Mother Lode" belt. See our VIIIth and Xth Reports, pp. 73 and 99. E. C. Voorheis, of Sutter Creek, owner.

*Oneida Mine* (Quartz).—This is 2 miles N. of Jackson, on the "Mother Lode." See our VIIIth and Xth Reports, pp. 79 and 109. It has been idle for a long time. Seligman Bros., of Anglo-Californian Bank, San Francisco, owners.

*(Original) Amador Mine* (Quartz).—It is in and N. of Amador City.

*Philadelphia Mine* (Quartz).—It is on the "Mother Lode," 4 miles N. of Plymouth. The course of the vein is N. and S. and dips about 70° E. An old location and patented. J. J. Crawford et al., of Placerville, owners.

*Pioneer Mine* (Quartz).—This property is S. of New London, about 1½ miles S. from Plymouth. It is one of the oldest locations on the "Mother

Lode," and after an idleness of many years was rehabilitated in the fall of 1893; new hoisting works were erected and prospecting commenced. A shaft has been sunk to a depth of 300 ft., and a fine body of high-grade ribbon rock reported developed. A 20-stamp mill is now (August, 1894) being erected. Dr. Thos. Boysen, of San Francisco (Palace Hotel), owner.

*Pioneer Mine* (Quartz).—See Argonaut.

*Plymouth Consolidated Mine* (Quartz).—It is in Plymouth. See our VIth, VIIIth, and Xth Reports, pp. 15, 42, and 117. These mines, once long famous for their long-continued output and large dividends, have been abandoned, and the machinery has mostly been removed. Hayward & Co., of San Francisco, 224 California Street, owners.

*Quartz Mountain Mine* (Quartz).—See Gold Mountain.

*South Eureka Mine* (Quartz).—It is a mile S. of Sutter Creek. See our Xth and XIth Reports, pp. 113 and 144. The shaft is now about 1,000 ft. deep. Low-grade quartz was encountered on the 500 ft. level. The fissure consists chiefly of crushed, foliated, and pulverized slate, with an occasional mass of quartz. It is the expressed intention to thoroughly explore the ground. South Eureka Mining Company, of Jackson, owners; J. F. Parks, Superintendent.

*South Mayflower (Bunker Hill) Mine* (Quartz).—This is owned by the same company controlling the Mayflower, though a separate corporation. See our VIIIth and Xth Reports, pp. 57, 75, and 114. The mine was idle in the fall of 1893, but it was to be reopened in 1894. South Mayflower Mining Company, of San Francisco, room 165, Crocker Building, owners; S. H. Emmons, Secretary.

*South Spring Hill Mine* (Quartz).—This is half a mile S. of Amador City. See our VIIIth, Xth, and XIth Reports, pp. 80, 73, 98, and 145. It has reached a depth of 900 ft., and is in constant operation. South Spring Hill Mining Company, of Lemonston, Mass., owners; J. R. Tregloan, Superintendent.

*Stewart Mine* (Quartz).—It is on the hill N. of Sutter Creek. See our VIth Report (Part II), p. 19.

*Summit Mine* (Quartz).—This claim is half a mile S. of Sutter Creek. See our Xth and XIth Reports, pp. 104 and 144. Idle. John T. Tregloan & Co., of Sutter Creek, owners.

*Sutter Creek Mine* (Quartz).—See Belmont.

*Tellurium Mine* (Quartz).—This property is 1 mile N. of Pine Grove, on the Volcano road. A large amount of work, including shafts, tunnels, and underground connections, has been done on this mine, exposing a well-defined vein in mica schist and altered diorite with a gray fine-grained dike rock. Sulphurets of iron, lead, zinc, and copper occur in the quartz, *but no tellurium*. Since the burning of the hoisting works some years ago, it has been idle. N. G. Young, of Volcano, Superintendent.

*Valparaiso Mine* (Quartz).—This claim is on the "Mother Lode," near Middle Bar. See our VIIIth Report, p. 42. It is scarcely beyond the prospective stage. Joseph Poggi & Co., of Jackson, owners.

*Wheeler Mine* (Drift).—This is near the village of Pine Grove. The property is partly hydraulic and partly drifting ground. J. T. Wheeler, of Pine Grove, owner.

*Wildman Mine* (Quartz).—It is within the town limits of Sutter Creek, and is at present the only property in operation at this place.

It is described in our VIIIth, Xth, and XIth Reports, pp. 75, 101, and 144. Since the last report a level at 1,100 ft. has been opened, and sinking is in progress for the 1,300 ft. level. It is said that there are considerable ore reserves above the 1,100 ft. level, though the mill was not in operation in November of 1893. The lower levels of this mine have developed in places 30 ft. of quartz. Where the amount of quartz is small the remainder of the fissure is filled with crushed slaty material and fragmental quartz. In retimbering a portion of the shaft the Superintendent resorted to a novel device to continue uninterruptedly the hoisting in the shaft. A chute, 12 in. square, made of 2 in. planks, was secured to the timbers in a corner of one of the compartments reaching from the 500 to the 600 ft. level. As fast as the old timbers were removed, all the refuse, waste dirt, rock, etc., were sent down the chute to the level below and hoisted in the regular way. As the work progressed (working downward) section after section of the improvised chute was removed. Wildman Gold Mining Company, of Sutter Creek, owners.

*Wolverine Mine (Quartz).*—This is at Sutter Creek, and lies between the Eureka and Wildman mines.

*Zeila Mine (Quartz).*—This is in Jackson, on the "Mother Lode." See our VIIIth, Xth, and XIth Reports, pp. 22, 85, 68, 104, and 139. The shaft is at the same level as at the time of the last report. The mine is being operated constantly. Zeila Mining Company, of Jackson, owners.

#### BUTTE COUNTY.

In this county all the different processes of obtaining gold are being carried on, and generally with satisfactory results. Among the mining properties are found placer, river, drift, hydraulic, and quartz mines. The county has also a large area of the finest agricultural and timber land, and is connected with the central markets of trade by two lines of railroad. With the exception of a comparatively narrow strip next the Plumas County line, the climate permits of work being carried on continuously throughout the year.

*Bader Mine (Drift).*—This is  $1\frac{1}{2}$  miles E. of Magalia. The work is somewhat of an exploratory nature, being carried forward to locate the exact course of the old river-bed, the gravel from which has similar features to that of the Smartsville channel in Yuba County. A bedrock tunnel, 900 ft. long, passes through a limestone belt, besides cutting through two quartz veins between slate walls. The course of the tunnel is N.  $30^{\circ}$  E., and it has tapped a fine body of old river-wash. It is still being run ahead to intersect the channel at a bend. For the first 700 ft. the tunnel required close and heavy timbering. The gravel drifts are  $4\frac{1}{2}$  ft. high, timbered with single posts and caps. About 7 in. of water comes from the tunnel and is used for washing the gravel. The dump holds about 40 carloads, of 1,500 lbs. weight each. The gold is worth \$17 50 to \$18 per ounce. G. Strauss et al., of San Francisco, owners.

*Bangor Mine (Drift).*—This is 1 mile E. of Bangor, in T. 25 N., R. 5 E. The company claims 2,400 ft. The channel, running N.W., is opened through a shaft 135 ft. deep and  $4\frac{1}{2}$  by 6 ft., closely planked. The main gangway is 305 ft. long, working up channel. The gravel drifts are from 25 to 35 ft. deep, and are carried 6 ft. high. The channel is 300 ft. wide



in the upper part, and about 80 ft. in the deeper part, which is somewhat cemented. There is about 40 per cent of cobbles and bowlders in the gravel. The best pay is in the cemented gravel; each breaster takes down 3 carloads per shift. The gravel is hoisted and run over a grizzly and through a 12 ft. arrastra run by steam power, which discharges through 180 ft. of 14 in. flume, with a grade of 14 in. to the rod. The upper boxes are cleaned up once a week, the remainder once a month. The gold is "scaly," and sells for \$18 15 per ounce. About 500 ft. of the channel have been worked; 1,750 ft. remain to be mined. Steam power, supplied from a 40 horse-power engine, does the work, 2½ cords of wood being consumed in twenty-four hours at an expense of \$3 75 per cord. Twenty-four men are employed. See our XIth Report, p. 164. F. W. Johnson, of Marysville, owner.

*Bessie Mine (Quartz).*—This mine is 1½ miles W. of Inskip, in Sec. 29, T. 26 N., R. 8 E. The claim contains 40 acres and has three veins, distinguished as the decomposed (No. 1), the sulphuret (No. 2), and the ribbon ledge (No. 3), all on an E. and W. course, with a slight dip to the S. No. 1 has an average width of 3 ft.; No. 2, from 1½ to 2 ft., and No. 3, from 4 in. to 1 ft. The veins have all been prospected through tunnels; they are about 300 ft. apart, in a granitic formation. The tunnels are, respectively, 70, 100, and 40 ft. in length. T. Salisbury et al., of Inskip P. O., owners.

*Butte King and Butte Queen Consolidated (Drift).*—This is 8½ miles E. of the Chaparral House, in Sec. 20, T. 25 N., R. 5 E. The claims contain 2,150 ft. on the course of the channel by 1,000 ft. wide. For the present that part of the mine constituting the Butte King has been practically abandoned. The lava and pipe-clay capping is 150 ft. deep and about 1,000 ft. wide, while the channel beneath averages 5 ft. in thickness and 200 ft. in width. The gravel carries gold throughout, largely on the 5 ft. near the bedrock and toward the center and east rim; the west rim, where exposed, being apparently barren. The bedrock is granitic in part and partly quartzose schist. The present work will open the east of the channel on the Butte Queen ground. The tunnel has been run 469 ft. to the inside of the west rim, thence starting across and partly with the course of the channel 300 ft. A water-blast furnishes ventilation through a 2 in. air pipe. The elevation above the sea at mouth of tunnel is 6,225 ft. See our Xth Report, p. 145. Butte King and Butte Queen Consolidated Mining Company, owners; J. W. Woods, of Chaparral, Superintendent.

*Butte Belle Mine (Drift).*—This claim is 2½ miles S.W. of Lovelocks, in Sec. 3, T. 23 N., R. 3 E., in Forks of the Butte Mining District. A bedrock tunnel is being run in the serpentine N.W. 590 feet, to intersect a channel coursing N. 10° W. along Big Butte Creek. The breast of the tunnel is supposed to be about 40 ft. from the channel rim. The ground is worth \$7 per foot to drift and timber. The claim embraces 159 acres of well-timbered ground and has a large and well-defined quartz vein running across it, on which gold prospects have been obtained. C. H. Ford, room 5, Crocker Building, San Francisco, owner.

*Butte Creek Mine (Quartz).*—This is 1 mile N.W. of Nimshew, on Big Butte Creek, in T. 23 N., R. 4 E. The property embraces 1,300 by 600 ft., through which an 18 to 30 in. quartz vein runs with a N.W. strike and a dip 45° E. There is a slate foot-wall and a limestone hanging-

wall. Two tunnels, about 70 ft. apart, have been run on the vein 160 and 80 ft., respectively, and this block of ground has been stoped; a second pay-shoot beyond has not yet been worked. A 10-stamp water-power mill, with 750 lb. stamps, reduces the ore, making 95 to 104 drops per minute. This mill is built at the upper level, and a water-hoist, using a 4 ft. Pelton wheel, conveys the rock to the upper level, from whence it is run to the mill. A 4 ft. Pelton wheel furnishes the power for the mill and a 10 in. wheel of the same pattern runs the two Frue concentrators. The mill is idle, as the tunnels are being pushed ahead. T. O. Carter, Big Butte Creek P. O., Nimshew, owner.

*Buzzard Mine* (Quartz).—This is 3 miles W. of Inskip, T. 25 N., R. 4 E., in Nimshew District. The claim is 3,000 by 600 ft., through which a quartz veinlet of extreme richness, often only 3 in. wide, strikes, with a N.E. course and S. dip. After extracting the quartz it is panned over and the tailings worked in an arrastra. Three tunnels, about 30 ft. distant, run into the hill; the two upper ones, 80 and 200 ft. long, and connected through an upraise, follow the vein. The third and lowest is a cross-cut 300 ft. in length, that has not yet cut the vein. The ore is sledded down hill to an arrastra 8 ft. wide, run by a 9 ft. undershot wheel, taking water from the Cherokee ditch, at a cost of 5 cents per inch. The arrastra makes from 14 to 16 revolutions per minute. T. Salisbury et al., of Inskip, owners.

*Catskill Mine* (Drift).—This mine is 1 mile N.W. of Bangor, in T. 25 N., R. 5 E. The claim employs 40 men when running, but is at present temporarily closed down. It contains 40 acres of ground, through which the same channel runs that is being worked by the Bangor Mine; about 1,600 ft. of the channel being estimated as within their lines, of which 600 ft. have been worked through a 210 ft. shaft, which reaches down to the bedrock. The gravel is from 12 to 14 ft. thick in places. Catskill Gravel Mining Company, owners; E. E. Meek, of Marysville, Secretary.

*Coleman & Paxton Mine* (Quartz).—This claim is located on Jordan Hill, 2 miles E. of the town of Paradise. W. T. Coleman, of San Francisco, owner.

*Cole Mine* (Drift).—See Xth Report, p. 144.

*Defiance Mine* (Quartz).—This mine is 9 miles N. of Oroville and 1 mile N. of Oregon City. There are two parallel veins, with slate and porphyry walls. There is a 90 ft. shaft on the vein. The quartz carries very few sulphurets. A. Ekman, of Oroville, owner.

*Denver and Rio Grande Consolidated Mine* (Quartz).—This mine is 3 miles W. of Forbestown. It has developed beyond a "prospect," on which a shaft is being sunk. — Price, of Forbestown, owner.

*Dog Hill Mine* (Drift).—This claim is 2 miles W. of Chaparral House, on the Magalia Ridge. It lies in T. 24 N., R. 5 E., and comprises 40 acres of ground, through which a gravel channel is supposed to run N.E. and S.W., and to cut which the company are driving a tunnel, at present 130 ft. long; 20 ft. farther they contemplate sinking, as they are too high, having struck lava after cutting through the rim. This ridge lies between the west branch of Feather River and the main branch of Butte Creek. Wetherbee et al., of Chaparral House, owners.

*Dutch Ravine Mine* (Quartz).—This is a prospect being developed 3 miles S. of Hurleton. A shaft has been sunk 135 ft.; the first 50 ft. vertical, the remainder on incline of 45°. The vein has a N. and S.

course, with a W. dip, and is from 2 to 5 ft. wide, between a slate hanging- and trap foot-wall. H. Stowe, of Forbestown, owner.

*Gold Bank Mine* (Quartz).—This property was described in our Xth and XIth Reports, pp. 125 and 162. The present ore supplies come from the stope on No. 2 drain tunnel level, No. 1 level E., and No. 3 level, on foot-wall side, W. On the No. 1 level E. the stope is 300 ft. long and the vein is 8 ft. wide. Two pumps are in the mine: an 8 in. plunger on the No. 2 level, and a 6 in. bucket pump on the No. 3 level, running with 5 ft. stroke. Motive power is water applied on six wheels under 150 ft. pressure. The crushing capacity has been increased by the addition of 20 stamps, or 40 stamps in all, with 16 Frue concentrators. The stamps are run from 90 to 100 drops per minute on a 7 in. drop, with about the same discharge, using narrow mortars. Both shoes and dies are steel, with a life only twice as long as good iron ones. No. 8 diagonal slot screens are used, which, when worn out, are used up in the chlorination works. Each stamp crushes  $2\frac{1}{2}$  tons in twenty-four hours. The pulp from the battery passes over an outside plate and 17 ft. of apron and sluice plates, set on a slope of 3 in. to the foot; also through sand-boxes and distributors before reaching the concentrators, which are producing 8 tons of sulphurets per week. The ore is passed through a No. 2 Gates crusher before reaching the mill, which is about 150 yds. distant from the hoisting works. The ore-bins have a capacity of 1,500 tons. The canvas tables below the concentrators are 60 ft. long, the sections being 22 in. wide. Settling-boxes are beyond, the material from which is chlorinated separately.

The chlorination plant handles 3 tons per day, making two charges. The furnace is a three-step reverberatory, with ten alternating doors. At the conclusion of the roasting proper, 5 lbs. of salt are introduced through each door on the ore, which is piled and remains heated for two hours before removing to the cooling floor. After cooling,  $1\frac{1}{2}$  tons are placed in an iron revolving barrel and mixed with 25 lbs. of sulphuric acid and 50 lbs. of chloride of lime, and water. The barrel is then closed and makes  $7\frac{1}{2}$  revolutions per minute for twelve hours. At the end of this the barrel is run on a track over the leaching-out vat, into which the charge is emptied.

The gold is leached with hot water, then "hypo" solution added without removing the charge, for the extraction of silver; and finally the copper precipitated as cement copper. The sulphurets, of which there are from 2 to 3 per cent in the ore, yield about \$40 per ton in silver. The concentrates give an average yield of about \$60 per ton. The ore can be mined and milled for \$2 25 per ton, exclusive of the chlorination. The ores from this mine produce a peculiar coating of a hard, blackish-brown substance over the apron plates, which adheres like plating and does not appear to be readily affected by acids. This may be a combination of selenium, arsenic, and mercury, or arsenic, sulphur, and mercury. The entire plant is lighted by electricity, and 78 men are employed. W. W. Stow, of San Francisco, owner.

*Golden Banner Mine* (Quartz).—It is situated 5 miles N. from Oroville, and has lately passed into the hands of a new company, who are erecting an extensive working plant. See our XIth Report, p. 153. F. McLaughlin, of Oroville, owner.

*Golden Feather Channel Company (Limited)* (Placer).—Up to date 600 ft. of the lower end of the channel have been worked; also a stretch



immediately below the permanent dam. Stripping off the debris covering the unworked portion was being actively prosecuted in October, 1893. The flume for washing is 550 ft. long and 2 ft. wide, with a grade of  $1\frac{1}{4}$  in. to the foot, and lined with 8 in. blocks. The tailings are elevated 60 ft. out of the bottom of the channel through a 21 in. pipe with a "hydraulic elevator." Fifty men work day and night, aided by electric lights. Fully illustrated in our XIth Report, p. 150. Golden Feather Channel Company, owners; F. McLaughlin, of Oroville, Manager.

*Golden Gate Alluvial Syndicate Company (Limited)* (Placer).—See our IXth and XIth Reports, pp. 271 and 152. Golden Gate Alluvial Syndicate Company (Ltd.), owners; W. G. Sanborn, of Oroville, Superintendent.

*Golden Queen Mine* (Quartz).—One half mile north of Forbestown. See our Xth and XIth Reports, pp. 120 and 162. At present 15 men are employed. C. Nickerson et al., of Oroville, owners.

*Golden Summit Mine* (Quartz).—This property is in T. 25 N., R. 5 E., Concow township, 10 miles E. of Chaparral House, and lies both in Butte and Plumas counties. It contains 5,000 by 100 ft.; the vein is 9 ft. wide, courses N.E. and dips W. At a distance of 100 ft. the tunnel cuts the ledge, on which it turns and continues for several hundred feet. An upraise connects the tunnel with the surface. The quartz is of ribbon texture and carries some sulphurets. A 10-stamp mill, supplied with Frue vanners, is being erected. Hon. Geo. C. Perkins, of Oakland, owner.

*Golden Thread Mine* (Quartz).—This property is on Secret Creek, 2 miles N.W. from Inskip, and comprises 1,500 by 600 ft., through which a veinlet 2 in. wide runs N. and S. and dips W.; the wall rocks are decomposed. A tunnel has been run 60 ft. on the vein, which has been stoped to the surface. Two 8 ft. arrastras with cog gearing are run by a 14 ft. overshot wheel with free water from Secret Creek. The gold is quite coarse. The property is worked by 3 men. G. W. Leeper, of Inskip, owner.

*Gregory Mine* (Drift).—This property is situated 9 miles E. from Chaparral House, in T. 25 N., R. 5 E., and is on the same gravel channel as the Butte King and Butte Queen to the south. The working tunnel has been run near the division line, and cuts through the rim rock 530 ft. from the mouth; here a shaft was sunk on the pitch of the rim rock 12 ft. deep, and a drift run across the channel 200 ft., where the breast shows the rim to be rising. The gravel averages 5 ft. in thickness, with a pipe-clay and lava capping. The gravel and water are hoisted by windlass, and the ventilating fan is run by hand-power. J. B. Dogle, of Chaparral House, owner.

*Index Mine* (Drift).—See Xth Report, p. 138.

*Inskip Mine* (Quartz).—This property is half a mile S.W. from Inskip, in Sec. 29, T. 25 N., R. 4 E. The claim of 1,500 by 600 ft. has two nearly parallel veins, with a N.E. course and a S. dip; they are about 20 ft. apart. No. 1 vein is from 6 in. to 3 ft. wide; the other about  $2\frac{1}{2}$  ft. A drift has been run between and parallel with the veins a distance of 100 ft., with intention to cross-cut to both veins; from this level there are 125 ft. of backs. The ore is hand-sorted and the better quality hauled to an 8 ft. arrastra run by a 16 ft. overshot waterwheel, the Cherokee Water Company's ditch furnishing 20 in. of water at a cost of \$10 per month. Thomas McVeigh, of Inskip, owner.

*John Dix Mine (Drift).*—This property is 6 miles N. of Lovelock station, on the North Fork of Big Butte. The property comprises 200 acres, and after lying idle for a long time, is having a hoisting and pumping plant put in shape to reopen it. The old incline tunnel, which is being put in shape, was started in gravel on a slope of 2 ft. in 12 for a distance of 500 ft. The total width of the channel is 500 ft., 200 ft. of which constituted the pay streak. Four out of every five carloads taken from the channel are boulders. The tunnel is extremely small; 4 ft. on bottom, 3 ft. on top, and using 6 ft. posts. The car contains only 18 cu. ft. The course of the channel is S.W., and it is supposed that the channel holds this course all the way down the ridge that lies between Oroville and Chico, no spot having been discovered where it breaks out. Bank of Chico, Chico, owner.

*Jones Bros. and Reese Mine (Drift).*—This property is 10 miles E. of Chaparral House, in Sec. 29, T. 25 N., R. 5 E. It is a southerly continuation of the Butte King and Butte Queen, and in this claim the channel breaks out. Its south continuation between this point and the Snow Diggings on the opposite side of the bank of the West Fork of Feather River has been entirely eroded. The elevation above the sea of the bedrock here is 6,140 ft. The main tunnel starts on the gravel near the west rim and runs in about 450 ft., and is connected by a cross-drift with an old tunnel run on the east rim, securing good ventilation. The gravel is breasted out 35 ft. wide and 5 ft. high, using posts and caps for timbering. The bedrock is partly syenite and partly a quartzose slate. When crevices are found the yield is quite large. The narrower the channel the richer the gravel, the gold being all coarse. The gravel is very clayey, but more so on the east than on the west rim; it also contains a large amount of quartz. The grade of the bedrock is irregular, making in one place a fall of 4 ft., below which point the ground was extremely rich. About 20 carloads of gravel are washed at a time with the 3 in. of water that drain from the tunnel, passing through 120 ft. of flume provided with cross and slat riffles. The upper cross riffles are cleaned twice per week, the remainder once a month. The mine is only run during the summer months. Jones Bros. et al., of Chaparral House, owners.

*Keystone (Reasner) Mine (Quartz).*—This property was described in our Xth Report, p. 127, and is situated 1 mile W. of Forbestown. A shaft has been sunk. The formation is syenite. D. Reasner, of Forbestown, owner.

*Kickapoo Placer Mine (Drift).*—This mine, formerly hydraulicked, is  $3\frac{1}{2}$  miles N.W. of Strawberry Valley, on the Mooreville Ridge, T. 20 N., R. 7 E. The property consists of two patented claims, the Kickapoo and the Burgstresser placers, containing 48 and  $60\frac{3}{4}$  acres, respectively. The bank is 150 ft. deep, including a 20 ft. lava capping, 10 ft. of a sand streak, and the 120 ft. of gravel. Next to the granite bedrock the gravel contains many large boulders. A 200 ft. tunnel has been run on the bedrock, and drifts run out to both sides for a distance of from 40 to 50 ft. without reaching either rim; the course of the channel is E. and W. The gravel is gray, somewhat cemented, and prospects throughout the whole depth, but is best on the lower 6 ft., some parts having yielded from 25 cents to \$1 per pan several feet from bedrock. It will be breasted down from 6 to 8 ft. deep. The gold is not coarse, and is .940 fine. The

water supply for three or four months is taken from Rock and French creeks. J. H. Drake et al., of Strawberry Valley, Yuba County, owners.

*Lost Treasure Mine* (Quartz).—This property is on Dutch Gulch, situated  $\frac{3}{4}$  of a mile N. of Inskip, in Sec. 28, T. 26 N., R. 4 E. It contains 1,500 by 600 ft., and carries quartz stringers, each about 12 in. wide, striking N.E., on which a tunnel has been driven 150 ft. The wall rocks are decomposed altered syenite. The gold occurs in pockets. J. Hedges et al., of Chaparral House, owners.

*Lucky Bob Mine* (Quartz).—This property is situated on Feather River, 4 miles N. of Oroville. The vein crops out near the banks of the American River, and courses a little W. of N., dipping  $55^{\circ}$  W. It is about 2 ft. wide, between greenstone walls, and occasionally a little slate. A tunnel has been driven on the vein 550 ft. A crew of 60 men are working. Col. F. McLaughlin, of Oroville, owner.

*Lucretia Mine* (Drift).—See Perschbaker.

*Magalia Consolidated (Mineral Slide) Mine* (Drift).—This property has been described in our VIIIth and Xth Reports, pp. 117 and 145. The claim embraces 400 acres of patented ground. Several tunnels have been driven under the lava capping, reaching a distance of 1,300 ft., and disclosing an extremely wide body of gravel. No breasting was being done, the gravel drifts being run ahead  $3\frac{1}{2}$  ft. high. In the main gangways the timbers consist of  $6\frac{1}{2}$  ft. posts,  $3\frac{3}{8}$  ft. caps in the clear, and  $5\frac{1}{2}$  ft. spread. The pay extends throughout the gravel, right up to the lava capping. The bedrock is partly slate, partly sandstone, the latter fossiliferous. To work the gravel successfully a deeper bedrock tunnel is required. The present cost of extracting a carload of gravel is 40 cents. Ten carloads (100 lbs. each) are extracted per man; the total width of the gravel is half a mile. N. D. Rideout et al., of Oroville, owners.

*Mammoth Gold Mine* (Quartz).—This property is  $1\frac{1}{4}$  miles N.W. from Inskip, in Sec. 30, T. 25 N., R. 4 E., and consists of a full quartz claim, 1,500 by 600 ft. The vein is 10 in. wide, and courses E. and W., with vertical walls of porphyry and granite. A shaft 4 by 6 ft., sunk to a depth of 20 ft., has been drifted from about the same distance, and this block of ground stoped to the surface. Not being worked at present. Messrs. Leeper & Cory, of Inskip, owners.

*Mascot Mine* (Quartz).—This property is situated 6 miles from Oroville. The claim consists of 4,500 by 600 ft., with a N. and S. vein 1 to 8 ft. wide, dipping  $60^{\circ}$  E., between greenstone and porphyry, the latter being the hanging-wall. A cross-cut tunnel 165 ft. long reaches the vein, which has been drifted on 26 ft. N. and 80 ft. S., giving 280 ft. of backs. A 10-stamp water-power mill, with 1,000 lb. stamps, and two Woodbury concentrators, belong to the property. The mill uses No. 35 punched screens, and has a 12 ft. apron set on a grade of  $1\frac{1}{2}$  in. to the foot. Four men are working the mine; the mill is not running. Mascot Mining Company, owners; A. Gabriel, of Woodland, President.

*Mineral Slide Mine* (Drift).—See Magalia.

*Oro Fino Mine* (Drift).—This property was described in our VIIIth and XIth Reports, pp. 118 and 160. There are 80 acres in the property. The channel, with S.E. course, is lava-capped; the bedrock, serpentine and slate; has an altitude of 2,340 ft. The present working tunnel started on an outbreak of gravel, and was run to the S.E. a distance of 750 ft., where a smaller channel or feeder ran into it. The main gangway is extended 3,000 ft., and shows the course of the channel at that



point to be a horseshoe bend. The gangway drifts are carried 5 ft. high, with about 40 ft. wide breasts; the timbering in the latter are single posts and caps. The main gangway has 6 ft. posts, with 5 ft. spread at the bottom. The gold is smooth, well-washed, and sells for \$17 75 per ounce. L. Cohen, of Magalia, owner.

*Pactolian Mine* (Quartz).—This property is 2 miles N. of Hurleton, T. 19 N., R. 5 E., and shows a vein from 2 to 8 ft. wide. L. Jacobs et al., of Oroville, owners.

*Palace Mine* (Drift).—This 80-acre claim is  $1\frac{1}{2}$  miles W. of Lovelock, on Big Butte Creek, T. 25 N., R. 3 E. The channel is supposed to have an E. and W. course. The former tunnels being too high, a new bed-rock tunnel has been started in the greenstone, and is in 30 ft. at present. P. Reardon, of Lovelock, owner.

*Palo Alto Mine* (Quartz).—This property has been described in our Xth and XIth Reports, pp. 129 and 164. The 3 ft. vein courses N. and S., dips about  $75^{\circ}$  E. Palo Alto Mining Company, of Merrimac, owners.

*Parry (Alki) Mine* (Drift).—See our Xth Report, p. 141. It is situated 2 miles N.E. of Magalia. For seven years the owner, with very limited means, has been sinking an incline on the west branch of Feather River, to tap the deep channel that is supposed to follow down the Magalia ridge. The twisting off of the  $3\frac{1}{2}$  in. steel crank shaft caused the mine to fill up with water in thirty-six hours, shutting down the works temporarily. The vertical depth reached is about 250 ft. G. Parry, of Magalia, owner.

*Perschbaker (Lucretia) Mine* (Drift).—This property was mentioned in our VIIIth Report, p. 110, and is situated on Little Butte Creek,  $2\frac{1}{2}$  miles N. from Magalia, in Sec. 13, T. 23 N., R. 3 E. The channel is only from 4 to 20 ft. wide, with steep grade. It is supposed to be a branch, and to join the deep channel under the Magalia ridge. It makes considerable water, and ten pumps are required to control it, four boilers 4 by 16 ft. being required. Two compressors are run by water power, with 110 ft. head, operating on two 5 ft. Knight wheels. From mouth of incline to bottom of the works is 250 ft. perpendicular, and the present bedrock is about 200 ft. below the level of Butte Creek. The work has been down the channel; the general grade is 12 ft. in 100. The gold is very coarse, and in places almost covers the bedrock; it is worth from \$18 75 to \$19 per ounce. N. D. Rideout, of Marysville, Yuba County, owner.

*Phoenix Gold Mine* (Quartz).—This property is 3 miles S. of Hurleton and 15 miles from Oroville, in Sec. 28, T. 19 N., R. 5 E. It embraces three claims (4,500 by 600 ft.), with 600 acres of timber land. The vein, 2 to 8 ft. wide, has a N. and S. course between decomposed wall rocks, well mineralized, standing nearly vertical. The main working shaft is 105 ft. deep. The hoist is a patent horse-whim. Short drifts are run from the shaft N. 33 ft. and S. 50 ft.; some stoping has been done. About 1 mile from the mine is the mill, a Bryan roller, with a Stanford self-feeder and Dodge rockbreaker. The mill makes 18 to 20 revolutions per minute, crushing 12 tons in twenty-four hours, and using a No. 40 diagonal slot cut screen. An apron 5 by 15 ft. carries the pulp to a Johnston concentrator; 80 per cent of the amalgam is obtained inside the mill. Below the concentrator is a canvas plant 40 ft. long, and a riffled sluice having a grade of 1 ft. in 6. The quartz has a ribbon structure and carries 3 per cent of iron and copper sulphurets.

Ore hauling costs 60 cents per ton. The mine is ventilated by means of a stove placed at collar of the shaft. J. L. Gibson et al., of Hurleton, owners.

*Porphyry Point Mine* (Quartz).—See our XIth Report, p. 161.

*Porphyry Point Mine* (Drift).—It is  $3\frac{1}{2}$  miles N. of Magalia, and contains 30 acres, through which a channel is supposed to run N.E. and S.W. A bedrock tunnel 75 ft. in length was run in porphyry, then an incline for 90 ft. that reached a perpendicular depth of 22 ft. The gravel has not been reached, but sediment is showing in the face. See our XIth Report, p. 169. R. Shipley et al., of Magalia, owners.

*Rainbow Mine* (Quartz).—This property was described in our Xth and XIth Reports, pp. 131 and 158, and is situated on Jordan Hill, 4 miles N.W. of Yankee Hill. Captain Griffith, of San Francisco, owner.

*Republican Mine* (Drift).—This property is situated 4 miles N.W. from Lovelock, on "Forks of the Butte," in T. 24 N., R. 3 E., and contains 140 acres. Course of the channel is slightly S. of E., and 1,200 ft. of it has been worked. The gravel drifts have been run at right angles from the main gangway 50 ft. in gravel without touching the rim rock. The gravel is worked 4 ft. deep with 25 ft. breasts. The bedrock is slate and granite, the channel running part way on the contact. There are two qualities of gravel: the red and the regular blue. The gold is smooth-washed; a breaster can take out 6 cars per day; the best pay is on the bedrock, 1 ft. of which is picked up. An old tunnel 200 ft. long is used as a reservoir, and the washing is done once a day through 160 ft. of sluices, using Hungarian and slat riffles; the head box is cleaned once a week, the remainder once a month. About 400 ft. from daylight in the tunnel the bedrock makes a 4 ft. raise. A belt of slate filled with quartz seams passing through the country rock would seem to justify its working, as where the outlet cut was made through it pieces of good-paying quartz were picked up, apparently from a pocket. P. N. Woods, of Lovelock, owner.

*Scott's Bar Mine* (Placer).—This property is 3 miles W. of Lovelock, on Big Butte Creek, in T. 24 N., R. 3 E. The property comprises 1,100 ft. along Butte Creek, and is 790 ft. wide. The pay ground is in a bar of Big Butte Creek running under the present bank, and a tunnel 30 ft. deep is run into it. The water of the creek is brought down through  $2\frac{1}{2}$  miles of ditch and affords 120 ft. pressure. The flume is 200 ft. long, 2 ft. wide, paved with blocks and pole riffles. The upper box is cleaned once a week, the remainder once a month; 200 carloads can be washed per day; 60 per cent of the washed material is bowlders. J. Leechman et al., of San Francisco, owners.

*Shakespeare Mine* (Quartz).—This property was described in our Xth and XIth Reports, pp. 128 and 163, and is situated in Forbestown. It gives employment to 50 men, 30 being in the mine. The 4 ft. vein, which is very strong, crops out for several hundred feet with an N. and S. course and a dip of about  $80^{\circ}$  W. Since being under the control of the present management, the mine has been fully equipped with steam hoisting works, a 30-stamp mill, and a chlorination plant. From the incline shaft to the mill is a loop incline tramway, the descent of the full car bringing the empty one up. The formation is syenite and greenstone, the former projecting into the latter between the mill and hoist. The general character of the quartz is similar to that of the Gold Bank Mine, but the character of the sulphurets appears more diversified.

The 30 stamps, of 1,000 lbs. each, drop 100 times per minute. There are battery plates, but no aprons; only sluice plates. There are also 12 Frue concentrators and a chlorination plant, using direct generation of chlorine gas. No silver or copper is saved, although the works are prepared to save silver. The capacity is for 5 tons of concentrates per day, but they only work 3 tons per twenty-four hours at present. The reverberatory furnace has working doors on one side only, the inter-spaces between the doors being beveled off on the inside. The new shaft is down 250 ft. and drifting has commenced. Col. A. Hayward et al., of San Francisco, lessees; — Nickerson, Superintendent.

*Standard Gold and Silver Mining Company (Quartz).*—This property is at Oregon City, 8 miles N.E. of Oroville; it is an old mine that is being reopened. The present claim includes 4,500 by 600 ft. The 2 ft. vein courses N.W. and S.E. and dips about 45° E; it has greenstone walls. The quartz carries about 1 per cent iron sulphurets. The present work includes an incline shaft 250 ft. deep, on the pitch of the vein, with N. and S. drifts at the 100 and 200 ft. levels. From the upper drift stopes connect with the surface. The power is supplied by a 10 horse-power steam engine; a No. 6 Knowles pump controls the water, and a 4 ft. Bryan roller mill crushes the ore. The works employ 26 men. E. T. Jewell, of San Francisco, Secretary.

*Turner Mine (Drift).*—This property is 1 mile E. of Bangor, in T. 25 N., R. 5 E. The claim controls 1,000 ft. on the channel, which is N.W. and S.E., and has a width of about 40 ft. The pay gravel is 8 ft. deep, but a capping of barren gravel reaches the surface. There are two 50 ft. shafts on opposite sides of the channel, and drifts are being run from both across the channel. The bedrock is slate. Timbers used are posts 6 ft., caps 3½ ft. in the clear, with 5 ft. spread. A 6 in. jackhead pump, run by steam, consumes 1½ cords of wood per twenty-four hours, at an expense of \$2 per cord. The boiler is 26 horse-power. The grade of the channel is 3 ft. in 100. An arrastra, tank, and flume are being built. Water is obtained from the Forbestown ditch, 7 in. being used, costing 10 cents per inch. The gold is flaky, and worth \$18 50 per ounce. Gravel is tight, but not cemented. Turner Drift Mining Company, of Marysville, owners.

*Wood's Mine (Drift).*—See Xth Report, p. 144.

#### CALAVERAS COUNTY.

This county boasts the largest producing gold mine in the State, and there are many properties which promise, with complete equipment, to become as great as any of those now operating. Several old mines have recently been reopened near Murphys, and the Gwin Mine, after years of idleness, is again in operation. Besides the quartz industry, there are 50 miles of the ancient gravel channels remaining unworked.

*Adelaide Mine (Quartz).*—It is on the "Mother Lode," at Robinson's Ferry. See our Xth and XIth Reports, pp. 57 and 169. It was worked in a small way during 1893. Harvey Woods, of Robinson's Ferry, owner.

*Angels Mine (Quartz).*—It is N. of Angels. Described in our VIIIth and Xth Reports, pp. 141 and 150. J. V. Coleman, of San Francisco, owner.

*Balaklava Mine (Drift).*—It is 2 miles S.E. of Vallecito, and is part of what is called the Cataract channel; this channel extends southeastward into Tuolumne County. Luke Sanguinetti, of Vallecito, owner.



*Bald Hill Mine* (Quartz).—See Graham.

*Banner Mine* (Quartz).—See Mayflower.

*Beatrice Mine* (Quartz).—It is near the Buckhorn, and is idle. W. S. Edwards, of Murphys, Superintendent.

*Beatrice Mine* (Quartz).—See Mayflower.

*Belle Mine* (Quartz).—It is on the southeastern slope of Carson Hill, near the Stanislaus River, and is a new property in course of development. A cross-cut tunnel 210 ft. in length intersects two veins 25 and 15 ft. wide and 75 ft. apart. A third vein cropping on the surface will probably be cut by this tunnel a short distance farther in. Drifts have been run 70 ft. N. on the first vein, and 200 ft. S. on the second.

*Birney Mine* (Quartz).—This is a new "prospect" on the Birney ranch, 1½ miles N.E. from Angels. The four owners of the mine are developing it. A shaft has been sunk 110 ft. There are eleven veins of quartz known on the surface, and two "blind veins" have been discovered beneath. These veins all occur within a zone 200 ft. wide. Good prospects are obtained on several of these veins. In sinking on two veins of 18 in. and 24 in. they have widened at the 100 ft. level to 4 ft. each of pay rock (quartz and schist). These veins all occur in altered diabase (chloritic and talcose schist), and contain from 3 to 4 per cent auriferous iron sulphurets. The geological features of this mine thus far greatly resemble those of the Utica Mine, at Angels Camp. T. L. Birney & Co., of Angels, owners.

*Blair Consolidated Mine* (Quartz).—See Smith's Flat and our XIth Report, p. 172. A new shaft was being sunk in 1893. James Schmedake, of Angels, owner.

*Blazing Star Mine* (Quartz).—This and the adjoining property, *The Water Lily*, owned by the same company, is 1½ miles E. of West Point. Described in our VIIIth Report, p. 414. Since then the workings have been carried down to the 450 ft. level. The concentrates were formerly sent away, but will now be treated at the mine, where custom work will also be taken. C. J. Moore, of West Point, Superintendent.

*Boston Mine* (Quartz).—This is 2½ miles N.E. of Mokelumne Hill, on Indian Creek. Patented under the name of *Esperanza*. The vein or zone of gold-bearing quartz occurs on a much splintered and crushed dike of diorite of dark greenish-gray color. The zone of fracture is 40 to 60 ft. wide. The quartz contains iron, lead, zinc, and copper sulphurets. It is without wall or well-defined limits. Interstratified or intermingled with the irregular masses of quartz are strips and bunches of chloritic and talcose schist, altered from the diorite country rock. A large amount of work has been done here. M. Davidson, of Mokelumne Hill, owner.

*Bruner Mine* (Quartz).—It is on the "Mother Lode," 2 miles S.E. of Angels. Referred to in our Xth and XIth Reports, pp. 59 and 174. F. Bruner, of Angels, owner.

*Buckhorn Mine* (Quartz).—It is 2 miles W. of Murphys. It is now being reopened after a long period of idleness. Two veins are exposed on the surface 140 ft. apart. A cross-cut tunnel 275 ft. long cuts one of them, exposing a fine banded vein 2 ft. in width. This vein is of the branching character common to many veins in slaty rocks. The formation here is mica schist and quartzite with dike rocks, one of which accompanies each vein. The mine has not been worked to any great

depth. It was worked for fourteen years in a desultory sort of way. F. R. Garnier, of Murphys, Superintendent.

*Buckminster Mine* (Drift).—See Uptograph.

*Calaveras Mine* (Quartz).—This is 5 miles N. of Murphys, on the Sheep Ranch road, and, after a long period of idleness, resumed operations in January, 1894.

*Calaveras Consolidated Mine* (Quartz).—It is on the southern slope of Carson Hill, at Robinson's Ferry. See our Xth and XIth Reports, pp. 56 and 169. During the summer of 1893 a new vertical shaft was sunk, cutting at 230 ft. in depth a shoot of quartz. W. J. Scrutton, of Angels, Superintendent.

*Canape Mine* (Quartz).—This claim is 1 mile W. of the old town of Carson. It is a small prospect, but yields a high-grade quartz. Jos. Canape, of Carson, owner.

*Carson Creek Mine* (Quartz).—It is on lower Carson Creek, at its junction with the Stanislaus River. This property has been erroneously referred to in our XIth Report, p. 173, as the "Jones Mine." The formation is highly metamorphic rock of indefinite character, probably a much altered slaty or schistose diorite. The mine is opened by an incline shaft 250 ft. deep, and there is also a vertical shaft of 140 ft. There are 700 ft. of levels and drifts. On the 100 ft. level two cross-cuts were run, one 70 ft. and the other 90 ft., without finding a wall. The quartz carries 0.5 per cent of sulphurets, mostly iron and zinc. Some of the latter is extremely rich in silver and has been mistaken for hessite (silver telluride). Twenty stamps were added in 1893 to the twenty already in place. Tulloch concentrators, sixteen in number, are in use. A chlorination plant is in contemplation. The *Belle Mine* is under the same management. E. W. Roberts, of Angels, Superintendent.

*Central Hill Mine* (Drift).—This claim is half a mile W. of Murphys. A drain tunnel 3,000 ft. in length is being run from the vicinity of Douglas Flat, and was 1,600 ft. in in September, 1893. W. Thomas, of Douglas Flat, owner.

*Champion Mine* (Quartz).—It is  $1\frac{1}{2}$  miles west of West Point, and is 750 ft. deep, where the profitable ore shoot was exhausted, and work abandoned. The vein formed in a dike of diorite, having a strike nearly N. and S., and a dip of  $35^{\circ}$  to  $65^{\circ}$  W. The walls are very uneven, owing to pinches and swells in the dike mass. The outside country rock is hornblendic granite of even texture and light-gray color. The shaft was started on a small vein in the granite, which was quite rich; at a depth of 300 ft. the shaft entered a zone of chloritic and talcose schists (locally called serpentine and slate). A large lens-shaped mass of quartz was encountered at a greater depth, which reached diagonally from wall to wall, pitching S., and was followed downward 400 ft., and produced a large amount of bullion. A small quartz vein was found on both foot- and hanging-wall of the dike, but neither contained sufficient gold to pay. S. Rufino, of West Point, owner.

*Chappellet Mine* (Drift).—This claim is in Chile Gulch, 2 miles S.W. of Mokelumne Hill, and is on the Chile Gulch channel. A new hoist and mill were built in 1893, and are in successful operation. F. Chappellet, of Mokelumne Hill, owner.

*Cook Mine* (Quartz).—It is  $1\frac{1}{2}$  miles N.E. of Angels, and adjoins the Birney Mine. The vein, from 1 to 4 ft. wide, occurs in a light-gray dike

rock. The surface quartz is much disintegrated and stained with iron oxides, and is heavily sulphuretted. S. Cook, of Angels, owner.

*Crown Point and Teirakoff Mines* (Quartz).—These adjoining properties are on the north side of the South Fork of the Mokelumne River,  $2\frac{1}{2}$  miles N.W. of West Point. They are on the "Champion dike," and have similar geological features. In the Crown Point Mine a shoot of quartz was extracted, which occupied a position nearly midway between the walls of the dike and lying parallel with them. Work is now being prosecuted in the Teirakoff Mine in search of a similar deposit. Here occasional transitions between the normal crystalline diorite and completely altered schists may be found. Teirakoff Company, of West Point, owners; — Marchand, Superintendent.

*Demorest Mine* (Quartz).—It is  $6\frac{1}{2}$  miles S. from San Andreas, and has reached a depth of 107 ft. The vein is 5 to 7 ft. wide, and the quartz is dark blue and carrying 3 or 4 per cent of iron sulphurets. D. D. Demorest, of Altaville, owner.

*Dodson & McQuaid Mine* (Quartz).—It is a mile S.W. of Murphys. The vein is 18 in. wide, and the quartz is blue and banded, and carries iron and lead sulphurets. The formation is black slate. Dodson & McQuaid, of Murphys, owners.

*Dora Mine* (Quartz).—It is 3 miles N. of Murphys. A tunnel and other workings expose a vein 1 ft. in width, some of which is rich in gold. A 5-stamp mill is about completed. George Hengen, of Murphys, Superintendent.

*Eclipse Mine* (Quartz).—It is  $1\frac{1}{2}$  miles N.W. of Angels (see Smith's Flat). A new shaft was being sunk in 1893. T. E. Flagg, of Angels, owner.

*Edna Mine* (Quartz).—It is 3 miles N.W. of San Andreas. The developments consist of a shaft nearly 100 ft. deep, and a cross-cut of 35 ft. The cross-cut passes through a dike of granular, buff-colored, heavily mineralized rock, 36 ft. in width, which is gold-bearing from wall to wall, with the exception of 5 ft. of hard rock near the middle. Near the west wall several large masses of quartz containing gold have been found, but were not developed in 1893. J. S. White, of San Andreas, owner.

*Esperanza Mine* (Quartz).—See Boston.

*Eureka Mine* (Quartz).—This location is 1 mile N. of West Point. A new shaft is down 100 ft. The 5-stamp mill is a quarter of a mile distant, where it is run in connection with a sawmill; the waste of the sawmill supplying fuel for both. The vein, from 1 to 3 ft. wide, is a simple fissure in granite, and has sustained a curious cross fracturing. The quartz breaks freely from the walls, but there is no selvage or gouge. Joel Rowe, of West Point, owner.

*Everlasting Mine* (Quartz).—This patented claim is half a mile S. of San Andreas. See our Xth Report, p. 63. N. Seiffort, of San Andreas, owner.

*Fellowcraft Mine* (Quartz).—This is on the eastern outskirts of San Andreas, and is described in our Xth and XIth Reports, pp. 149 and 178. Herman Bode, of San Andreas, owner.

*Finnigan Mine* (Quartz).—It is on Carson Hill, and is being worked in a small way for pockets. Tarbut, Bickel & Co., of Angels, owners.

*Gold Cliff Mine* (Quartz).—This property is being operated as one of the Utica group, and is on one of the branches of the "Mother Lode,"



just W. of Angels. It has a somewhat unusual geological structure. See our Xth Report, pp. 60 and 150. Hayward, Lane & Co., of Angels, owners.

*Gold Hill Mine* (Quartz).—This is half a mile S.E. of Vallecito. The vein, having a N.E. course, is a fissure in diorite, and is accompanied by a dike of felsite. It is a "pocket" claim, and said to have produced largely. Johnson & Burnell, of Vallecito, owners.

*Gold Hill Mine* (Quartz).—This property is  $1\frac{1}{2}$  miles N.W. of Angels. See Smith's Flat and our Xth Report, p. 170. The surface portion of the mine is a labyrinth of cuts, trenches, and drifts, made in mining for rich pockets. There are over 2,500 ft. of shafts and levels, exclusive of the surface cuts. That portion of the mine which is below 100 ft. from the surface is now being developed in a systematic manner. S. V. Ryland, of Angels, owner.

*Graham (Bald Hill) Mine* (Quartz).—It is on one of the branches of the "Mother Lode," a mile south of Angels. See our Xth and XIth Reports, pp. 150 and 174. L. Graham, of Angels, owner.

*Guadalupe Mine* (Quartz).—See Homestead.

*Gwin Mine* (Quartz).—It is on the "Mother Lode," 3 miles W. of Mokelumne Hill. This famous mine is completely described with sectional plates in our VIth Report, p. 30. It is now being reopened, and fine hoisting works, capable of lifting 3,000 ft., are being erected. Gwin Development Company, owners; F. F. Thomas, of Mokelumne Hill, Superintendent.

*Hale Mine* (Quartz).—This location is half a mile W. of Angels. See our Xth Report, pp. 60 and 147.

*Hardy Mine* (Quartz).—This is situated 1 mile S.E. of Angels. It consists of a broad zone of alternating magnesian schists and quartz veins of greatly varying size. Considerable work, mostly of a superficial character, has been done. Structurally, the mine is somewhat like the Utica. Considerable gold has been taken out in pockets. Two men make a living "pocket mining" on this claim, which should be operated in a larger way to secure the best results. Hardy & Osborne, of Angels, owners.

*Hillary Mine* (Quartz).—See Lone Star.

*Holland Mine* (Quartz).—It is 2 miles S. of San Andreas. At this mine a hoist and mill were erected to work a mass of talcose schist said to contain auriferous iron pyrite. All operations were suspended after a short trial. W. Holland, of San Andreas, owner.

*Homestake Mine* (Quartz).—This is in a small district 5 miles E. of Murphys. The settlement is called Collierville. The region is distinguished for the high-grade quartz, which occurs as lenses and veins in mica schist. Geologically it is similar to the mines about American Camp, on the opposite side of the Stanislaus River. The mines are on the "east lode." In the Homestake, which may be taken as a type of the entire group, there are two fissures nearly parallel, strike E. and W., and 3 to 8 ft. apart. The schistose rock between these crevices is much disturbed and crushed. The foot-wall is well defined, while the hanging-wall crevice is rarely well defined for any considerable distance. The quartz lies in a small vein on the foot-wall side of this crushed rock; branching and reticulated veinlets sometimes unite and form a solid mass up to 28 in. in width. It is claimed that at one point (inaccessible) the vein is 8 ft. wide. W. Collier, of Murphys, owner.

*Homestead and Guadalupe Mines* (Quartz).—They are in the Glencoe District,  $1\frac{3}{4}$  miles S.E. of Glencoe, which is largely granitic in character. The property was being reopened in the fall of 1893, after a long period of idleness. S. Tyson, of Glencoe, Superintendent.

*Hudson Mine* (Quartz).—It is on the western side of Central Hill, and half a mile N. of North Branch Post Office, 4 miles S.W. of San Andreas. The vein is 3 to 5 ft. wide, and dips to the S. A vertical shaft was sunk and was continued in the foot-wall, but no cross-cut was ever run to cut the vein. M. Angels, of San Andreas, owner.

*Ilex Mine* (Quartz).—It lies between Mokelumne Hill and West Point. See our VIIIth Report, p. 135. Idle.

*Illinois Mine* (Quartz).—It is 6 miles S. of San Andreas. See our Xth Report, p. 149. After a long period of idleness work was resumed late in 1893. Ben Thorne, of San Andreas, owner.

*Iron Rock Mine* (Quartz).—This is on the northern slope of Carson Hill. The name is derived from the occurrence of a vein of hematite in the fissure. It has been explored for pockets only. Richard Cohen, of Vallecito, owner.

*Jones Mine* (Quartz).—See Carson Creek.

*Keltz Mine* (Quartz).—It is 4 miles N.E. of West Point, and is in granite similar to the Eureka and Blazing Star mines. In operation in 1893. O. A. Peaseley, of West Point, Superintendent.

*Kentucky House Mine* (Quartz).—This is  $2\frac{1}{2}$  miles S. of San Andreas, on the Copperopolis road. It is a new prospect, and has a shaft 60 ft. deep. John Seiffert, of San Andreas, owner.

*Lamphyre Mine* (Quartz).—It is a short distance N. of the Moser Mine, and covered by an agricultural patent, although a promising prospect.

*Lane and Tulloch Mine* (Quartz).—See Matson.

*Last Chance Mine* (Quartz).—On the southeastern slope of Carson Hill. Adjoins the South Carolina. James Wood, of San Andreas, owner.

*Lewis Mine* (Quartz).—See Gold Hill.

*Lone Star Mine* (Quartz).—This property, which also includes the Reed & Hillary vein, is  $2\frac{1}{2}$  miles W. of West Point. It is the largest property being operated at present in this section. The veins, of which there are two important ones, are 50 to 140 ft. apart, strike a little E. of N., and dip generally to the W. The inclosing rock is hornblending granite of normal type. The linear extent of the workings exceeds 7,000 ft. The bunches of quartz which constitute the vein occur as replacements in the granite, crushed between a series of fault planes, some of which are nearly perpendicular and parallel, and a second series which pitch to the W. at an angle of  $15^{\circ}$  to  $40^{\circ}$ . The ore shoots have a pitch to the N. at an angle of  $30^{\circ}$ . The sulphide minerals are iron, zinc, and lead; a large percentage of the iron pyrites (pyrrhotite) are magnetic, and seriously disturb the working of the magnetic needle. See our Xth Report, p. 152. Lone Star Mining Company, owners; M. Hurley, of San Francisco, President.

*Louisa Mine* (Quartz).—This is 3 miles W. of Murphys. A cross-cut tunnel 120 ft. long has been driven to the vein, and a drift 300 ft. long was run on the vein, when it encountered caved ground in an old shaft. The veins are small but rich. The fissures have a branching tendency. Granite dikes accompany all the veins. The formation is mica schist and quartzite. The dike rock at times appears to cut the quartz out entirely. Carley Bros., of Murphys, owners.

*Matson (Lane and Tulloch) Mine (Quartz).*—This is in the townsite of Angels, and is the south extension of the Gold Cliff. See our Xth and XIth Reports, pp. 59, 151, and 171. The property is being actively worked. The shaft is between 900 and 1,000 ft. deep, the greatest depth reached in this vicinity (the collar of the shaft is nearly 200 ft. lower than that of the Utica-Stickles). The rock extracted in prospecting keeps 20 stamps in constant operation. The "reserves" are very extensive. The reported expense of mining and milling is but little over \$1 per ton. This mine uses the waste water from the Utica hoists and mill. A 32 ft. overshot wheel supplies power to the mill, and a hurdy wheel runs the hoist. Two Frue and two Tulloch concentrators save the coarser sulphurets, no attempt being made to save the slimes. Hayward & Lane, of Angels, owners.

*Mayflower (Banner) Mine (Quartz).*—It is  $1\frac{1}{2}$  miles W. of Murphys. After a long idleness this mine is being reopened. There are two veins, one of which is called the "Mayflower" and the other the "Banner." The formation is mica schist and quartzite. The veins strike nearly E. and W. and dip  $85^{\circ}$  N. They conform to the strike and dip of the enclosing rocks. The Mayflower vein is 4 ft. wide. There are several smaller veins lying back in the foot-wall, which may join the main fissure in depth. Two shafts are being sunk on the Mayflower vein, 600 ft. apart, and a level is being run to connect them, 118 ft. from the surface in the deeper shaft. A cross-cut is also being run on the level to cut the Banner ledge, which lies north of the Mayflower. The *Total Wreck* and *Beatrice* claims also lie north of the Mayflower. An old tunnel, 400 ft. long, running across a portion of the Beatrice ground, has been reopened and is being driven in through the Total Wreck, and will be continued to a connection with the workings on the Banner and Mayflower veins. New hoists have been built and active mining operations on a large scale inaugurated. W. S. Edwards, of Murphys, Superintendent.

*McQuaid Mine (Quartz).*—See Dodson.

*Melone's Mine (Quartz).*—This claim is on the "Mother Lode," on the southern slope of Carson Hill, near Robinson's Ferry. After producing a large amount of gold from pockets, work was abandoned and the mine has now lain idle for years. It produced several varieties of *telluride*, among them being the rare melonite (telluride of nickel). Geo. W. Grayson, of San Francisco, owner.

*Morgan Mine (Quartz).*—It is on the "Mother Lode," at the summit of Carson Hill. See our IXth and Xth Reports, pp. 37 and 57. Jas. G. Fair & Co., of San Francisco, owners.

*Moser Mine (Quartz).*—This is situated on Spring Gulch, within a mile of Mokelumne Hill. The workings are immediately under a portion of the Tunnel Ridge gravel channel, and all above the level of the tunnel. Two veins, 4 or 5 ft. apart, and ranging from a few inches to 6 ft. in width, are being mined. The country rock is slate. A dike accompanies the vein, and it is said that on the contact the rock is richer. The sulphurets (2 to 3 per cent) are iron, lead, and zinc. The quartz is crushed in a new 10-stamp mill, provided with concentrators. W. T. Harris & Co., of Mokelumne Hill, owners.

*Moser Mine (Hydraulic).*—This claim, on Tunnel Ridge channel, is on the east side of Spring Gulch, near the Moser Quartz Mine. W. T. Harris & Co., of Mokelumne Hill, owners.



*Moyle Mine* (Drift).—It is 2 miles S.E. of Vallecito, on the Cataract channel. J. Moyle, of Vallecito, owner.

*New York Mine* (Quartz).—This is 2 miles N.E. of Railroad Flat. The vein is from 8 to 12 in. in width. It contains iron and copper sulphurets and occasionally galena. It has a small hoist and mill. James Prentice, of Stockton, owner.

*Norfolk Mine* (Drift).—This claim is a mile S.E. of Murphys. The channel is much disturbed, portions of it standing vertically, and all parts of the deposit standing at a high angle, and are much broken. The extent of the workings is too limited to discover the cause of this disturbance, but it appears to be partly due to the intrusion of igneous material and faulting of the rocks. The mine is worked through an incline shaft 200 ft. deep, and has a well-arranged hoisting and sluicing plant. T. B. Morse, of Murphys, Superintendent.

*North Trojan Mine* (Quartz).—See Trojan.

*Oro y Plata Mine* (Quartz).—This is located on the hillside just N.W. of Murphys. It is equipped with a complete hoisting and milling plant, but is now idle. Frank Morse, of Murphys, Superintendent.

*Particelli Mine* (Quartz).—This is a new "prospect," 3 miles W. of Mokelumne Hill. A small force of men is employed. Colonel Robinson, of Mokelumne Hill, Superintendent.

*Phillips Mine* (Hydraulic).—This claim is 3 miles N.E. of Mokelumne Hill. It is owned by residents of the town, and was actively worked in 1893. C. M. Burleson & Co., of Mokelumne Hill, owners.

*Quaker City Mine* (Quartz).—It is 3 miles S.W. of Mokelumne Hill. See our VIIIth Report, page 144. The only work in progress was that of keeping the pumps in motion, retimbering, and maintaining accessibility. A. Knell, of Mokelumne Hill, Superintendent.

*Rathgeb-Union Group of Mines* (Quartz).—This property is on Calaveritas Creek, 3 miles S.E. of San Andreas. See our Xth Report, p. 63. W. Holland, of San Andreas, Superintendent.

*Reed & Hillary Mine* (Quartz).—See Lone Star.

*Reserve Mine* (Quartz).—It is on the eastern side of Carson Hill, near the summit of the mountain. See our Xth Report, p. 58. George W. Grayson, of San Francisco, owner.

*Riverside Mine* (Quartz).—This is 2½ miles W. of West Point, on the same vein and adjoining the Lone Star on the S. It was idle in October, 1893, but work was about to be resumed. F. J. Severns, of West Point, owner.

*Safe Deposit Mine* (Quartz).—See Smith's Flat and our XIth Report, p. 172. Charles Smyth, of Angels, owner.

*Sheep Ranch Mine* (Quartz).—This property is in the town of Sheep Ranch. Described in our VIth, VIIIth, and XIth Reports, pp. 30, 131, and 175. The shaft is somewhat deeper since then, but otherwise the conditions are unchanged. W. H. Clary, of Sheep Ranch, Superintendent.

*Shenandoah Mine* (Quartz).—This property is 9 miles N.E. of San Andreas, on the north side of Jesus Maria Creek, and is reached by road via El Dorado. The country rock is hydro-mica schist and quartzite, east of which is an area of amphibole rocks and diorite; these rocks strike N.W. The system of fissures constituting the Shenandoah Mine strike N. 25° E. and dip 80° E. The vein has a decided branching tendency, and is accompanied by dike rocks of fine granular texture. The

vein is usually banded where more than 6 in. in width. The central portion of the vein, which extends over two spurs of the main ridge, has, by the weight of the mountain, here bent over to the E., giving it a dip of 50° to 65° W. It may be that the torsion of the rocks has resulted in a fault, but as yet it has not been discovered. The best portion of the property lies at the north end, but it is too far distant from the mill for economical operation. A lack of pressure or insufficiency of water also puts the property at a disadvantage. The mine is in active operation. See our XIth Report, p. 176. This mine is owned by an Oakland company, with offices in the Masonic Building.

*Sheridan Mine* (Quartz).—This is a new "prospect," one fourth of a mile below Robinson's Ferry, on the Stanislaus River. The vein, from 2 to 10 ft. wide, may be considered as belonging to the "Mother Lode" series. It has a clean, well-defined hanging-wall, but no foot-wall, the vein striking out into the black slate in many veinlets. The quartz is splintery and stained with iron oxides and azurite. It is being developed. Thomas Richards, of Robinson's Ferry, owner.

*Sloane Mine* (Drift).—This claim is on the Cataract channel, 2½ miles S.E. of Vallecito. It is being worked continuously. Sloane & Sons, of Vallecito, owners.

*Smith's Flat District*.—In a general way all the veins of this region are quite similar, being veins and lenses of quartz in slaty, splintery, and schistose diabase, altered to chloritic and talcose schists. Reticulated systems of small quartz veins are also common. The principal mines are the Blair Consolidated, Eclipse, Gold Hill, Safe Deposit, Smyth (formerly Suffolk), Star of India, Turner, and Yellowstone. There are three parallel zones of gold-bearing rock. The Star of India is on the west, the Blair, Turner, Eclipse, and Gold Hill on the central, and the Smyth on the east zone. Still farther east are the Gold Cliff and Utica systems. See our Xth Report, p. 60.

*Smyth (Suffolk) Mine* (Quartz).—See Smith's Flat District and our VIIIth Report, p. 126. A cross-cut was being made in 1893. Chas. Smyth & Co., of Angels, owners.

*South Carolina Mine* (Quartz).—This is on the southeastern slope of Carson Hill, and is working. W. H. Worden, of Angels, owner.

*Spring Gulch Mine* (Placer).—This claim is on Spring Gulch, 3 miles N.W. of San Andreas, and is opened on a recent alluvial deposit, which is "piped" loose and shoveled into sluices. In active operation, and said to pay handsomely. J. S. White, of San Andreas, owner.

*Star of India Mine* (Quartz).—See Smith's Flat District.

*Stickles Mine* (Quartz).—See Utica.

*Suffolk Mine* (Quartz).—This property is one fourth of a mile E. of Carson Hill, on two broad zones of gold-bearing quartz and talcose and chloritic schists. The mineral zones are each about 50 ft. in width, and separated by nearly 50 ft. of diabase. With the larger masses of quartz intrusive dikes occur. Nothing has been done here except superficial work. I. Copeland, of Vallecito, owner.

*Suffolk (Smyth) Mine* (Quartz).—See Smith's Flat District. Chas. Smyth & Co., of Angels, owners.

*Teirakoff Mine* (Quartz).—See Crown Point.

*Total Wreck Mine* (Quartz).—See Mayflower.

*Trojan and North Trojan Mines (Quartz).*—These are 3 miles N.W. of West Point, on the north side of Mokelumne River, and on the "Lone Star" vein. Wilson & Co., of West Point, owners.

*Tryon Mine (Quartz).*—It is 3 miles S.E. of Angels, and described in our VIIIth Report, p. 129. Chas. Tryon, of Angels, owner.

*Tulloch Mine (Quartz).*—This is about  $2\frac{1}{2}$  miles S.E. of Angels, and is on the "Mother Lode" series, being a zone of quartz veins in magnesian schists. Some of the quartz is rich in gold. A new shaft was being sunk in 1893. Calcite and mariposite also frequently occur in the veins. Jas. Tulloch, of Angels, owner.

*Turner Mine (Quartz).*—See Smith's Flat District.

*Utica-Stickles Mine (Quartz).*—These properties are in the town of Angels, and have been heretofore described in our VIth, VIIIth, Xth, and XIth Reports, pp. 28, 122, 150, and 171. The general geological structure of this section is described in our Xth Report, p. 60. The mineral belt, or "Mother Lode," in this part of Calaveras County has a width of 3 miles, from the Birney Mine on the east to the Star of India Mine on the west. The shafts of the Utica and Stickles mines are now (1893) 1,000 and 1,100 ft. deep, respectively. The three shafts start on the vein at the surface, but at a depth of 500 ft. the vein takes a somewhat lesser dip, but the shafts continue at the same angle in the foot-wall. The stopes of this mineral zone are from 10 to more than 100 ft. wide. In these broad portions are found ribs or masses of rock containing little or no gold. The entire gold-bearing zone, as it must be called in contradistinction to a simple vein, consists of a great mass of altered diabase, which by shearing and pressure has been rendered splintery or slaty, and subsequently altered to chloritic and talcose schists, with the infiltration of much silica into the magnesian rocks, and the replacement of large masses of crushed diabase by solid massive quartz. Both the quartz lenses, bunches, and veins, and the magnesian schists, contain gold and auriferous pyrites.

Between masses of quartz are frequently seen irregular bunches, and often reticulated veins, of quartz. Perfect series of transition rocks, from normal diabase to a typical talcose schist, may be obtained in almost any portion of the mine. Power drills are used. With an Ingersoll drill a drift 8 by 8 ft. was run 196 ft. in thirty days, working three eight-hour shifts. The timber used in these mines is exclusively round and mostly large size; few sticks being under 18 in. in diameter in the main sets and many being 24 in. and 30 in. Sprags are 12 to 16 in. The cost in timbering is approximately 30 cents per ton of ore extracted. In good ground headings are made without timbering, but it is usually found safer, and a better plan, to timber as fast as excavation proceeds.

The manner of lowering timbers into this mine is interesting, but is only possible in shafts that are vertical, or nearly so, without constructing a slide or chute. The timbers, sawed to the proper length, are delivered at the collar of the shaft. A number of chains, about 8 ft. in length, provided with a dog at each end, are at hand; a workman selects a chain, drives a dog into one side somewhat above the middle of the timber, passes the chain over the end of the log and down the opposite side, where the other end is secured by driving that dog into the log. A rope 5 ft. in length, with a spike at one end, is secured to the opposite end of the log by driving the spike well in. At a convenient time the skip is hoisted above the collar of the shaft and a hook is caught



into the ring in the chain. The engineer hoists slowly until the heavy timber hangs suspended over the shaft, the rope at the bottom being used to steady it, and also to land it at any desired level. This is found to be a convenient method of handling the timbers, and does away with the necessity of block and tackle at the several stations. There is no loss of time and no interference with the use of the skips for other purposes by this method.

The absence of waste dumps at the Utica is noticeable. All waste broken in sinking the shafts and in all dead work is utilized in filling up old stopes, and as the amount obtained from these sources is insufficient, considerable waste is taken from the walls, large chambers being excavated for this sole purpose in the hard diabase. There are 350 men employed in the mine, reduction works, etc. Miners' wages are \$3; shovelers and other underground laborers, \$2 50. Hayward, Lane & Co., of Angels, owners.

*Uptograph (Buckminster) Mine (Drift).*—This claim is at Douglas Flat, 6 miles N.E. from Angels. It is on the Central Hill channel, and was formerly worked by the hydraulic method. An upper "lead" is now being drifted upon, with good results. T. Uptograph, of Murphys, owner.

*Vallecito Consolidated Mines (Drift and Hydraulic).*—These are located between Douglas Flat and Vallecito, and comprise a valuable tract of land. The company owning these mines contemplate the driving of a tunnel 7,000 ft. in length to drain them, the construction of a ditch and flume 26 miles in length, and the building of storage reservoirs in the mountains. I. Copeland, of Vallecito, Superintendent.

*Washington Mine (Quartz).*—It is 5 miles N. of Murphys, but it has not been worked for several years.

*Water Lily Mine (Quartz).*—See Blazing Star.

*West Point District.*—This is an interesting district, geologically. The mines are in a granite belt striking N. and S., and is at least 6 or 7 miles wide. Southward the granite appears to alter into dioritic and hornblendic rock; its northern limits are not known further than that the granite extends 6 or 8 miles N. from West Point. Through the granitic area numerous dikes of fine-grained, dark-green diorite are found, having an E. and W. course. Dikes of diorite of light greenish-gray color and coarse texture also occur, striking nearly N. and S. These latter appear to be the older, and often accompany important veins of the district.

A strange idea prevails in this region, viz.: that the granite is a "cap" rock, beneath which may be found serpentine and slates, and that the veins under the granite will be found larger, richer, and more permanent with increase in depth. That such was not the case was amply proven by a careful geological investigation of the region. The basis for this remarkable theory was discovered, however, in the Crown Point, Teirakoff, and Champion mines (on the "Champion dike"), the latter being formerly a large producer, but now idle.

*Whittle Mine (Quartz).*—It is 1 mile W. of Carson Hill. John B. Reddick, of San Andreas, owner.

*Willard Mine (Quartz).*—It is half a mile E. of Murphys. While in fact a quartz vein or series of veins, it was formerly worked by the hydraulic method, as are the "seam diggings" in El Dorado County. See our VIth Report (Part II), p. 35.

*Yellowstone Mine* (Quartz).—See Smith's Flat District and our XIth Report, p. 172. Chas. Smyth, of Angels, owner.

COLUSA COUNTY.

Although chiefly one of the richest agricultural counties, yet a portion of its revenues are derived from the mining of gold and quicksilver ores found in the rolling hills adjacent to Lake County. That this work has been intermittent lies partly in the peculiar occurrence of these ores, making their profitable exploiting a matter of close financiering and complex workings. Of late the increased facilities of transportation have encouraged the opening of good quarries and the manufacture of salt. Valuable mineral springs may also be counted among the wealth producers of this section.

*Clyde Mine* (Quartz).—This is situated in Sulphur Creek Mining District. Only "prospect work" was done at this mine during 1893-94. See our XIth Report, p. 183.

*Keely Mine* (Quartz).—This is in the Sulphur Creek District. See our XIth Report, p. 184.

*Manzanita Mine* (Quartz).—See Manzanita Quicksilver and Gold Mine.

DEL NORTE COUNTY.

*Bald Hill Mine* (Placer).—Several parties are working it in a small way. The pay gravel is over 6 ft. deep, and is said to pay well throughout.

*Big Flat Mine* (Hydraulic).—This claim lies on Hurdy Gurdy Creek, and contains 640 acres of gravel. The mine has yielded a large amount of gold, but is idle at present. The ditches were destroyed several years ago by excessive rains, and have never been repaired or rebuilt.

*Craig's Creek*.—The bars along this creek are rich throughout. Mining, however, is limited to the cradle and rocker, the creek bed only being worked. The land is patented to the lumber firms and is not obtainable by the miner at present. Bernard Purnische, of Crescent City, owner.

*Miller Mine* (Hydraulic).—It is on Smith River, 6 miles E. of Crescent City. A ditch and pipe-line are now under construction, and work will soon be resumed. R. W. Miller, of Crescent City, owner.

*Musick Mine* (Placer).—This lies below and adjoining the Miller Mine, and is worked by both sluice and rocker. The gravel, from 1 to 4 feet deep, is trammed by car to the sluice, where it is washed by water raised from the river by a current wheel. Besides gold, platinum is found in the clean-up. Ben Musick, of Crescent City, owner.

*Preston Peak* (Quartz).—Quite a flurry was caused some time ago by the discovery of gold quartz in this vicinity, and no doubt some good veins occur in the neighborhood, as many rich specimens were brought in, but owing to its inaccessibility, developments have been retarded.

*Rice's Mine* (Placer).—It lies on Mill Creek, and contains 20 acres of a bar; it is worked in a small way by sluicing. The gold, being coarse, lies exclusively on the bedrock; the gravel is practically worthless. H. Rice, of Crescent City, owner.

*Yates' Beach Mine*.—One mile S. of Crescent City, Mr. Yates is washing the beach sands. About 50 in. of water are brought through a flume

12 by 12 in. to the washer. The beach at this place is littered with logs and driftwood, and the sand taken out from among them is shoveled into wheelbarrows and dumped on the washing machine, which consists of a table 3 ft. wide and 11 ft. long. From there the mixture flows onto another table 6 by 8 ft., which tends to more evenly distribute it over the whole surface. The lower end of this table consists of a screen of sheet-iron, with  $\frac{1}{4}$  in. punched holes, where the gravel, driftwood, etc., are retained. The clean sand then flows over corrugated plates 6 ft. long, set at an angle of  $14^{\circ}$ , and thence onto a table covered with coarse blanket, and having a square well 4 in. deep at its upper and lower ends to catch escaping quicksilver. There are three men employed to wheel sand and one man keeps the screens clear and tends to the machine. It is said that about \$5 is taken out to the man employed. A. L. Yates, of Crescent City, owner.

#### EL DORADO COUNTY.

This county is as well supplied with gold-bearing veins as any part of the mineral belt, and is equally well furnished with facilities for water power, and better than some as regards timber. The formations do not show the same regularity which is found along the "Mother Lode" in the counties south; the slates have in part been greatly crushed and altered, and the granitic rocks come lower down the ridges. It is in this county that the so-called *seam diggings* have found their greatest development, furnishing a large proportion of the gold output of the county with comparatively small outlay for permanent plants, making it possible for men of small means to engage profitably in the mining business. There is considerable of this kind of ground still awaiting the miner's advent. Unfortunately, agricultural patents covering these, in a measure put a barrier in the way of the prospector, and lose to the community the possibility of an increased output of gold from this direction.

During the writer's stay in Georgetown, parties plowing a field below town turned up quartz from a seam that yielded \$400 in gold, showing that in many parts the wealth below is more valuable than the product of the surface.

For years the county has not received the attention that its mineral wealth merits, but the success attending the deeper explorations in the Taylor, Springfield, Church, Big Cañon, Gentle Annie, and other mines should be an encouragement to other operators to delve deeper in their now idle mines.

*Adam's Gulch Mine* (Quartz).—It is 2 miles N. of Nashville, and is 1,500 by 600 ft. It shows a 2 ft. vein of quartz with a N. and S. course, on which two shafts have been sunk about 100 ft. deep. J. C. Heald, of Nashville, owner.

*Alpine Mine* (Quartz).—See our VIIIth Report, p. 167.

*Argonaut Mine* (Quartz).—See our Xth Report, p. 176.

*Armstrong & Roberts Mine* (Drift).—It is  $3\frac{1}{2}$  miles S. of Grizzly Flat, and contains 30 acres of ground. A channel 60 ft. wide runs through the ground in a N.E. and S.W. course, and is tapped by a tunnel 600 ft. in length. The channel is lava-capped. Pay gravel 5 ft. thick. The bedrock and most of the boulders are granitic. One man works the



claim, washing the extracted gravel two or three times a year. W. T. Armstrong and — Roberts, of Grizzly Flat, owners.

*Aultman Mine* (Quartz).—It is situated 2 miles E. of Greenwood, and is supposed to be on the same vein as the Idlewild Mine. It is 1,500 by 600 ft. of patented ground. The vein courses nearly N. and S., with slate and diabase walls, pitching slightly to the E. The walls contain considerable lime; small stalactites having formed in the drifts. The croppings have been exploited by an open cut over 30 ft. deep; a cross-cut tunnel driven at an expense of \$35 per foot has penetrated 500 ft., cutting the ledge 250 ft. below the croppings; at this point a shaft was sunk 35 ft. deep and drifts turned both N. and S. about 25 ft. The vein is 103 ft. wide between walls. The quartz is milk white and carries some iron sulphurets. The 2-stamp mill and office buildings have been destroyed by fire. Water power is available. Timber is plentiful. John Smith, of Greenwood, owner.

*Bald Eagle Mine* (Quartz).—See Crown Point Mine.

*Baldwin Mine* (Quartz).—It is 2 miles E. of Nashville, in T. 8 N., R. 10 E., and is 3,000 by 300 ft. The vein, 7 ft. wide, runs a little W. of N., and lies E. of the main "Mother Lode"; it dips toward the E. at an angle of about 60°; the walls are slate and porphyry. The vein carries 0.5 per cent sulphurets. Two shafts, supplied with steam hoisting works, have been sunk 175 ft. and 60 ft. deep, respectively, and drifts turned from the former. One foot of gouge accompanies the vein. They usually employ 7 men. E. J. Baldwin, of San Francisco, owner.

*Barnes Mine* (Quartz).—It is 2½ miles N.E. of Shingle Springs. The vein lies on the contact of serpentine and hornblende porphyry. Considerable work has been done on the surface along this contact, as shown by the numerous shallow openings, although but little quartz appears. The main workings consist of several shafts. This and other mines on this belt produce much telluride of gold. H. L. Robinson, of Placer-ville, owner.

*Base Bonanza Mine* (Quartz).—Located in Sec. 32, T. 12 N., R. 10 E. Well defined ledge; east wall diorite and west wall serpentine.

*Beattie & Parsons Consolidated Mine* (Seam Digging).—See our XIth Report, p. 203. It is situated at Georgia Slide, 1½ miles N. of Georgetown, in Secs. 3 and 34, Tps. 12 and 13 N., R. 10 E., and contains 60 acres on the south bank of Cañon Creek, on the porphyry seam belt. It is worked as a placer, the pit being about 150 ft. deep. The formation is traversed by slates and schists, and intercepted by numerous gold-bearing quartz seams, varying in width from almost nothing to several inches. The mass containing these seams is loosened by blasting and washed through 1,500 ft. of sluices, set on a grade of from 14 to 18 in. per box of 16 ft.; these being lined with 8 in. wooden blocks. If any gold is seen in the quartz, it is laid to one side and crushed in the hand mortar, but necessarily many such pieces escape and are washed into Cañon Creek. The upper boxes are cleaned up once or twice a week, and the remainder three or four times a season. Many of the slates in this belt carry from \$2 to \$3 per ton, mostly in coarse gold, which sells for \$18 50 per ounce. Beattie & Parsons Consolidated Placer Mining Company, owners; C. Beattie, Superintendent.

*Benfeldt Mine* (Drift).—See our VIIIth and Xth Reports, pp. 187 and 197.

*Berry Mine* (Quartz).—See True Consolidated.

*Bidstrup Mine* (Quartz).—It is in Logtown, and is a small claim, 800 by 400 ft. F. T. Bidstrup, of Mud Springs, owner.

*Big Cañon (Oro Fino) Mine* (Quartz).—See our VIIIth Report, p. 174. It is situated 5 miles S. of Shingle Springs, and has been newly equipped with steam and water hoisting works, air compressor, 20-stamp mill, and chlorination plant. The ore body is quite peculiar, and while it has its counterparts in several smaller ones in the vicinity, yet it is very different from the ordinary type of gold-bearing quartz veins. As shown in an open cut made on the croppings, the ore body occurs in the form of an immense lens, having an extreme width on the surface of more than 100 ft. and tapering toward both ends. The ends are not reached in the cut, which is 400 to 500 ft. long. This opening is 20 ft. deep in places, extending down to the undecomposed ore. The upper part of the material taken out was sluiced. At the time of examination, in October, 1893, the three-compartment shaft had reached a depth of 215 ft., costing over \$40 per foot, and cutting through the ore body 70 ft. The dip is a little less than  $40^{\circ}$  to the E.; the strike about N. and S. As far as the developments have gone, the hanging-wall has been found to be a serpentine schist, quite loose and difficult to hold up, while the foot-wall is a greenstone schist, judged to have resulted from the decay of a diorite or diabase dike. On the 100 ft. level a great chamber fully 100 ft. across has been excavated out of the massive ore body. No timber is used, the roof being held up by pillars of ore. On the hanging-wall several feet of ore is left to hold back the soft serpentine. An examination of this ore body shows it to be a very hard, compact, and fine-grained mass of gray quartz, which is thickly sprinkled with small but regular crystals of iron pyrites. Gold occurs both in the free state and in combination with sulphurets. The ore carries from 8 to 10 per cent of sulphurets. The ore body is sharply defined from the hanging-wall, but in places blends into the foot-wall in such a manner as to show conclusively that it is not a fissure vein in the usual sense, but occurs as a replacement of the green schist. Not only were excellent samples found of the gradual transition to this green schist by a decrease of the quartz and sulphurets, and an increase of the green chloritic matter, but several irregular bodies of ore were observed to lie wholly separated from the main one and to present every appearance of being replacements. More generally the contact between the ore and the foot-wall is rather sharp. The serpentine on the hanging-wall has a very limited extent, seeming to swing away from the ledge at both ends; on the S. being replaced by black slate, and on the N. by a decomposed rock, perhaps originally a diabase. Immediately E. of the serpentine is an irregular body of fresh diabase, precisely similar to that so characteristic of the "Mother Lode." The number and variety of the dikes in almost immediate contact with this ore body is quite remarkable.

A compressor, with capacity for eight drills, runs two in the shaft and one in the drift. Twelve men are engaged in sinking, and seven break ore for the mill. A tramway and elevator convey the ore into the mill, which is supplied with a rockbreaker and self-feeders. The mill is unique, the stamps being of the unusual weight of 1,400 lbs., this increase being obtained by a boss of 220 lbs. being attached to the upper end of the stem; the tappet increased to 345 lbs. with three keys; and the stems lengthened by 2 ft. The shoes are chrome steel and weigh between 120 and 130 lbs.; the dies are iron; the speed is 100 drops per minute, 7 in. high. The duty of these stamps is 2 tons each in twenty-four hours.

An 8 in. silvered plate is used on the front, inside the battery, and 3 miner's inches of water is required.

The apron plates are 14 in. by 4 ft., and each battery is supplied with a double set of sluice plates, enabling the cleaning of the same to proceed without hanging up the battery; these sluice plates are 18 in. wide by 27 ft. long, and are set on a grade of 3 in. to the foot. The batteries, which are cleaned up once a month, produce 30 per cent of the amalgam.

The sulphurets are hauled by wagon to the chlorination works about 100 yards distant. This plant is built for working 5 tons wet per twenty-four hours, using a reverberatory furnace, with single hearth 75 ft. long and working doors on both sides. Three gas generators and four chlorination vats comprise the plant, no silver being saved. The concentrates are worked upward of 90 per cent, the gold being .980 fine. The tailings are said to assay from \$1 to \$1 50 per ton.

The mill and concentrators take power from a 6 ft. Pelton wheel, working under 395 ft. pressure. The compressor and hoist are run by steam or water, the latter acting on a 6 ft. Dodd's wheel under 300 ft. pressure, delivered from the Crawford ditch through an 18 in. pipe. Forty men are employed. Big Cañon Gold Mining Company, owners; G. B. Pierce, Superintendent.

*Big Sandy Mine* (Quartz).—See our Xth Report, p. 173. It is situated in T. 10 N., R. 11 E., near Kelsey, on the porphyry belt. Big Sandy Mining Company, of Kelsey, owners; J. Kelly, Superintendent.

*Bitters Claim* (Placer).—This property is situated on Missouri Cañon, near Volcanoville, and comprises 80 acres of ground. W. Kinny and — Morgan, of Georgetown, owners.

*Black Lead Mine* (Quartz).—This mine lies 6 miles S. of Shingle Springs. It is so termed from the appearance of the quartz, which is quite black. As exposed in the old shaft, the vein appears to be inclosed in slate. The hoisting works and other buildings have all been burned.

*Blair Mine* (Drift).—See our Xth Report, p. 179.

*Blue Rock Mine* (Seam).—It is situated at Georgia Slide, adjoining the Beattie & Parsons seam mines on the N.E., and working the same seam belt. See our XIth Report, p. 203. Beattie Bros., of Georgetown, owners.

*Board Mine* (Quartz).—It is half a mile E. of Greenwood, and comprises two claims of 600 by 600 ft., side by side. The vein courses E. and W. and dips to the N., showing a 4 ft. vein. A tunnel has been run 60 ft., cross-cutting the slate; a second tunnel has been started to the north. W. Board, of Greenwood, owner.

*Bona Forsa Mine* (Quartz).—See our Xth Report, p. 177.

*Boneset Mine* (Quartz).—It is in T. 10 N., R. 9 E., 6 miles N. of Shingle Springs, near Weber Creek. The property extends three quarters of a mile N.E. and S.W. along the vein, which dips N. about 70°. The country rock is granite. The vein on the croppings shows a width of 30 ft. The quartz carries a fair percentage of iron and copper sulphurets, and has a lively character. A tunnel 130 ft. in length cross-cuts the vein 40 ft. below the croppings. From the Weber Creek side a good opportunity is afforded for a deeper tunnel, which would give 350 ft. backs. Water power can be brought on the claim. M. E. Gates, of Sacramento, owner.

*Bower Mine* (Seam).—See our XIth Report, p. 204.



*Brass's Claim* (Drift).—See Murzo Mine.

*Bright Hope Mine* (Quartz).—It is in Sec. 2, T. 12 N., R. 10 E., in the immediate neighborhood of Georgetown, and is a promising "prospect." See our Xth Report, p. 177. H. W. Hurlbert, of Georgetown, owner.

*Brown Bear Mine* (Quartz).—See our VIIIth Report, p. 182.

*Buckeye Hill Gold Mine* (Drift).—It is on Buckeye Hill, 9 miles N.E. from Georgetown and 2 miles W. of Volcanoville. It is an old river channel with a N.E. and S.W. course, 2,730 ft. above sea-level, and 1,000 ft. wide between rim rocks, carrying blue gravel with a red cement capping. Facing the American River, the west side of the claim was hydraulicked and shows a bank 127 ft. high, with alternating strata of gravel and cement; the facilities for impounding are quite favorable and the mine could be worked to greater advantage by this method.

From the east side of the claim a tunnel has been run into the channel 200 ft. through the slate rim rock; 150 ft. from the mouth an upraise of 35 ft. breaks into the gravel. The channel is quite steep, with a very uneven floor. The gravel breasts are 100 ft. wide and 5 ft. high on an average, although in places the gravel has been taken out 30 ft. high. As timber is scarce, after extracting the bottom gravel, which carries coarse gold, the timbers are recovered and the ground allowed to settle, losing the top gravel, which carries scaly gold. A bench of the main channel supplies the present output of gravel, which amounts to three carloads, of 1,500 lbs. each, to the breaster per day. The dump holds several hundred carloads. The dirt is washed with water from neighboring springs through 10 boxes, set on a 13 in. grade to the box, paved with slat riffles. The washing occurs once every two or three weeks. The gold sells for \$17 50 per ounce. J. J. Flora, of Georgetown, owner.

*Burt Alley Claim* (Placer).—It is 2 miles below the crossing on Otter Creek, of the Georgetown and Volcanoville trail, in T. 13 N., R. 11 E. It is 1,320 ft. along the course of the creek by 700 ft. wide. A bedrock cut is being blasted up the creek, to work some valuable virgin gravel, left from early days. A large amount of big bowlders have to be removed. Forni & Smeder, of Georgetown, owners.

*Cañon Creek Fluming Company's Mine* (Placer).—It is in Secs. 32, 33, 34, T. 13 N., R. 10 E.,  $1\frac{1}{2}$  miles N. of Georgetown and immediately below Georgia Slide. It embraces  $1\frac{1}{4}$  miles, or 150 acres, of patented ground in the bed of Cañon Creek. The ground is a tailings deposit, having been the dump from all the Georgia Slide and Oregon Gulch mines, which have been working off and on for the last forty years, but it also contains 10 to 15 acres of valuable virgin gravel. On account of a rocky reef across the creek at the lower end of the claim, all the quartz from the Georgia Slide mines has been retained on this ground. The company own an excellent water power. G. W. Simpers et al., of Greenwood, owners.

*Carrie Hale Mine* (Drift).—It is situated at Henry's Diggings,  $3\frac{1}{2}$  miles S. from Grizzly Flat, and contains 260 acres of patented land. The channel, which is capped by lava 100 ft. deep, runs N.E. and is 60 ft. wide, with from 5 in. to 5 ft. of gravel. The bedrock tunnel is 400 ft. long. The gravel is now being blocked out in 12 ft. breasts, carried  $5\frac{1}{2}$  ft. high, and timbered with single posts and caps. The gravel is blue, carrying granite bowlders and resting on a granite bedrock, next to which the best pay is found, though some gold is found scattered throughout. The gold is worth \$17 per ounce. The gravel is washed twice

a year, through 12 boxes, slat riffles; the water, which is taken from the Cole ditch, costs from \$1 50 to \$2 per twelve hours. The tailings are dumped into the Middle Fork of the Cosumnes River. J. H. Bradley, of Placerville, owner; H. C. Roberts, of Grizzly Flat, lessee.

*Cedarberg Mine* (Quartz).—This property is situated  $2\frac{1}{2}$  miles N. of Greenwood, and is 1,500 by 600 ft., through which runs a 2 ft. vein between slate walls having a N. and S. course, and an easterly dip at an angle of  $45^{\circ}$ . A shaft has been sunk 300 ft. deep on the vein. E. W. Hulford, of Oakland, owner.

*Cement Hill Mine* (Drift).—It is 4 miles from Georgetown. A prospect bedrock tunnel is being run to strike a gravel channel supposed to run E. and W. The tunnel, which is in slate, has reached a length of 550 ft.; at 150 ft. connection was made with the surface, 60 ft. above, through an air shaft. The ridge is lava capped.

*Central Mine* (Quartz).—See Inez Mine.

*Chester Mine* (Quartz).—Southerly extension of the Rose. See our VIIIth Report, p. 182.

*Chili Ravine Mine* (Drift).—Idle. See our VIIIth and Xth Reports, pp. 194, 179.

*China Hill Mines* (Quartz).—They are a mile N.E. of the Big Cañon Mine. A vast amount of work has been done here, chiefly in the form of surface cuts, though there are several tunnels and shafts. The gold is found in "pockets" in a N. and S. vein inclosed in hornblende porphyry.

*Church (El Dorado) Mine* (Quartz).—This property was described in our VIIIth and Xth Reports, pp. 191 and 171, and is situated in T. 10 N., R. 11 E., 3 miles S. of El Dorado; it is 1,500 by 600 ft., and is one of the deepest mines in the county. The present working shaft is a three-compartment, using skips; the workings extend from the 400 to the 1,000 ft. level. The plant contains a compressor for four Ingersoll drills, with an 8 in. Cornish pump, with two jackheads and two plungers. The ore from the present workings carries  $2\frac{1}{4}$  per cent of sulphurets, assaying \$140 per ton.

A new 10-stamp mill has been built; stamps 900 lbs. in weight,  $3\frac{1}{2}$  in. stems, 14 ft. long, giving 102 drops, of 5 in., per minute; discharge  $7\frac{1}{2}$  in. through a No. 40 mesh sheet-tin screen, with a duty of 2 tons per stamp in twenty-four hours. The plates consist of an 8 in. piece inside the battery; an apron 5 ft. by 5 ft., and 16 ft. of sluice plates 16 in. wide. The plates are scraped every day, and the battery cleaned up once a month; 75 per cent of the amalgam is taken from the latter. The gold is worth \$17 per ounce. The mill is provided with three Frue and one Johnson concentrator and a Dodge rockbreaker and Challenge self-feeders. The entire plant is operated by water power under a 400 ft. pressure, furnished from the Crawford ditch. Church Gold Mining Company, owners; J. Richards, of El Dorado, Superintendent.

*Church Union (Springfield) Mine* (Quartz).—See our VIth Report (Part II), p. 43. Idle.

*Cincinnati Mine* (Quartz).—It is  $2\frac{1}{2}$  miles S. of Placerville, in T. 10 N., R. 11 E. The claim is 1,300 by 600 ft. and the vein is supposed to be the same as the Epley, on the opposite side of Weber Creek. M. Miller and D. J. Knighton, of Diamond Springs, owners.

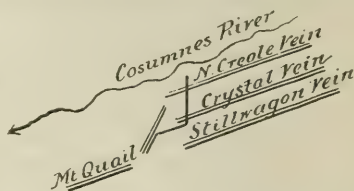
*Cinnamon Bear Mine* (Quartz).—Two miles N. of Placerville. Idle.

*Collins & Patterson Claim* (Placer).—This prospect is situated on the porphyry seam belt 2 miles N.E. of Georgetown, on Cañon Creek. Two men are sinking a shaft. Collins & Patterson, of Georgetown, owners.

*Cousin Jack Mine* (Quartz).—It is situated 5 miles S.W. of Grizzly Flat. It comprises 1,500 by 600 ft., with a N. and S. vein, dipping W. about 60°, and varying in width from 1 to 4 ft. The walls are slate. About 400 ft. to the E. is the contact with granite. Three tunnels have run on the vein; the deepest, 400 ft. long, gives 300 ft. backs; No. 2, 250 ft. above, is 300 ft. long; from this a winze 70 feet deep has been sunk on good-paying ore. The pay shoot pitches N., and is richest where the vein is narrow. Cole's ditch runs 300 ft. above the mine. About an inch of water runs from the tunnel. Timber is abundant. Mrs. M. Jeffrey, of Grizzly Flat, owner.

*Crown Point (Bald Eagle) Mining Claim* (Quartz).—It is 1½ miles S.E. of Diamond Springs, in Sly Ravine, 800 ft. E. of the Church Mine, and is 1,500 by 600 ft. The vein has a course N. 20° W., dip nearly vertical, within black slate walls. On the surface a number of small quartz stringers crop out. A two-compartment vertical shaft has been sunk. The present owners do only assessment work. The quartz carries some good looking sulphurets. J. Richards, A. Koch, and J. W. Estes, of Diamond Springs, owners.

*Crystal Mine* (Quartz).—It is in T. 9 N., R. 13 E., on the Middle Fork of the Cosumnes River, 5 miles S. from Grizzly Flat. There are four claims in the property. The Mountain Quail vein is in line with the Stillwagon vein, running E. and W., as do the Crystal and North Creole veins. The Creole vein is more N. and S., with a nearly vertical dip, whereas the others dip to the S.: the Crystal about 70°, and the Mountain Quail nearly vertical. There are 1,200 ft. on the Mountain Quail, 3,000 ft. on the Creole, and 3,200 ft. on the Crystal. Width of Creole, 4 ft.; Crystal, 4 to 6 ft., and Mountain Quail, from 3 to 10 ft. All these veins are in hard granite. In the Crystal the vein matter is not all quartz; along the foot-wall is the principal ore body. The Crystal has a shaft 250 ft. deep, and two drifts (65 ft. apart) 500 and 900 ft. long, and four ore shoots pitching W. The Mountain Quail has two ore shoots, varying in length from 50 to 150 ft. The North Creole has two ore shoots; the pay streak being 2 ft. thick; the shaft is 70 ft. deep. A main working tunnel (said to have cost \$80,000) has been driven by hand 1,208 ft. through solid granite to the Crystal vein, and is to be continued along that vein until it reaches the Mountain Quail. At present the mouth of the tunnel is caved and the tunnel filled with water. In the main tunnel an air shaft connects with the surface 200 ft. from the mouth, and where the tunnel intersects the North Creole a winze is sunk 65 ft. deep.



PLAN OF CRYSTAL MINE, EL DORADO CO.

An 8-stamp mill, with 650 lb. stamps, belongs to the property and is driven by water power acting under 200 ft. pressure on an 8 ft. Hurdy wheel. The company owns the water power. Its ditch is 1½ miles long. The mill is supplied with 16 ft. of apron and sluice plates, set on a grade of 2 in. to the foot, followed by 36 ft. of blanket sluices. L. L. Alexander, of Ohio Ranch, owner.

*Crystal Mine* (Quartz).—It is 3½ miles S. of Shingle Springs, in Sec. 28, T. 9 N., R. 10 E. The claim is 1,220 by 600 ft., and has a N. and S.



vein 3 ft. wide, dipping E.  $50^{\circ}$  between slate walls. An incline shaft 250 ft. deep, with steam hoist, connects with a tunnel below. A cross-cut tunnel, 70 ft. below the collar of the shaft, 350 ft. long, conveys the ore to the level of the hill. The latter has 10 stamps of 650 lbs. weight, and is worked by water power from the Crawford ditch under 112 ft. head, applied to two Pelton wheels of 4 ft. and 8 in. in diameter; the latter for the concentrators. The percentage of sulphurets in the ore is large. Idle. G. Phelps et al., of Mud Springs, owners.

*Dailey Mine* (Quartz).—It is on Clear Creek, 3 miles S. of Grizzly Flat. The claim is 3,000 by 600 ft., and shows a vein from 18 in. to 3 ft. wide, carrying a fair percentage of iron sulphurets, and striking N. and S. A tunnel started on the banks of Clear Creek has been driven on the vein 600 ft. At the mouth of the tunnel is a small rotary stamp used for prospecting purposes. Dailey et al., of Grizzly Flat, owners.

*Dalmatia Mine* (Quartz).—This property has been fully described in our VIIIth, Xth, and XIth Reports, pp. 177, 174, and 201. It is 8 miles N.W. of Placerville. Now idle, but to be reopened shortly. American River Syndicate (Limited), owners; C. G. Pearson, of Kelsey, Superintendent.

*Darling Mine* (Quartz).—See our XIth Report, p. 202. Idle.

*Davidson Mine* (Quartz).—This old mine lies 3 miles N.W. of El Dorado, on the eastern edge of the slate belt which runs north from Big Cañon. A 20-stamp mill was put up on this property many years ago for working a vein situated 100 ft. W. of the contact in the slate. On the contact is a large vein which has been worked but little, while but a few feet away in the slate is another closely resembling the Big Cañon ore body. The mine has been bonded, and it is expected that it will be opened up again.

*Defiance Mine* (Quartz).—This old mine is located 5 miles N.E. of Shingle Springs. Here is said to occur a large body of low-grade ore inclosed in green chloritic schists.

*Dividend Mine* (Placer).—It is  $2\frac{1}{2}$  miles W. from Shingle Springs, in T. 10 N., R. 9 E. The company own 3,136 acres of ground on Kelly Creek. The gravel deposit is quite extensive and worked through ground sluices. It has a soil capping of about 10 ft., making the stripping expensive; the gravel is from 1 to 3 ft. thick, lying on a soft granite bedrock, and contains a little quartz. Ground-sluicing is carried on during winter and spring; the season averages six months. The claim, though operated for a number of years, has plenty of good ground in reserve. About 2,000 ft. in length have been worked. Seven men are employed. The gold is .888 fine. The ground is poorly situated for dumping. The gold is apparently derived from numerous small seams throughout the bedrock in this vicinity. Ayl. Pelton et al., of Shingle Springs, owners.

*Donozo Gold Mine* (Quartz).—It is half a mile E. of Greenwood, and is 1,500 by 600 ft. It is on the same mineral belt as the Taylor Mine, showing in the 60 ft. of tunnel run on the vein a width of 20 ft., with a course N.  $40^{\circ}$  W. and dipping E. about  $55^{\circ}$ . J. Donozo, of Greenwood, owner.

*Eagle King Mine* (Quartz).—It is  $2\frac{1}{2}$  miles N. of Grizzly Flat, in close proximity to the Melton Mine, and is 1,500 by 600 ft. It has a N. and S. vein, dipping slightly to the W., with a width of from 2 to 4 ft.; the walls are a decomposed granite. The vein is worked through a tunnel driven 800 ft. on the ledge. A winze, 200 ft. from the mouth of the

tunnel, is 30 ft. deep, and shows 28 in. of a vein in the bottom, carrying iron, lead, and zinc sulphurets. A little stoping has been done at this point above the tunnel level. The entire length of the vein in the tunnel shows good milling ore. There are 300 ft. of backs, from breast of tunnel. No mill is on the property, but water power can be obtained through the Eagle ditch, with 200 ft. pressure. This section of country is very well timbered. The owner works alone. See our VIIIth Report, p. 178. J. Melton, of Grizzly Flat, owner.

*Edner, Charles, Claim (Quartz).*—It is 4 miles E. of Fairplay, and is 1,500 by 600 ft.; the course of the vein is N. and S.; the dip is to the E., between granite walls. A tunnel is run on the vein 150 ft., and in the gulch below a 20 ft. shaft has been sunk. The quartz carries considerable iron and lead sulphides. One and a half miner's inches of water issues from the tunnel. Water power can be obtained from the Michigan Bar ditch. C. Edner, of Omo Ranch, owner.

*El Dorado Mine (Quartz).*—See Church Mine.

*El Dorado Big Tunnel Mining Company's Mine (Quartz).*—Its property is situated 2 miles N. of Placerville, in Big Cañon, and comprises 120 acres. The tunnel was started on a N.E. course to cross-cut the mineral belt, from the east side of the cañon, and has penetrated to date 662 ft., cutting in that distance several quartz veins ranging from 3 to 6 ft. in width. At the end of the tunnel 97 ft. of the very finest quality of roofing slate has been penetrated. At the mouth of the tunnel is a 5-stamp mill, run by water power. El Dorado Big Tunnel Mining Company, owners; G. W. Campbell, of Placerville, Secretary.

*Elliot Mine (Quartz).*—It is  $2\frac{1}{2}$  miles S. of Placerville, in T. 10 N., R. 11 E. The claim, which is only 800 by 300 ft., is immediately opposite the Epley Mine, on the banks of Weber Creek, and the vein has the same N.W. course, and dips  $80^{\circ}$  E. The vein along both slate walls through the entire length of the claim is uncovered, showing 4 ft. of milky quartz with few sulphurets. A shaft sunk 50 ft. on the vein connects with a cross-cut tunnel from the creek. J. J. Elliot, of Placerville, owner.

*Emma Mine (Quartz).*—See our Xth Report, p. 176.

*Epley Mine (Quartz).*—See our VIIIth and Xth Reports, pp. 186 and 173.

*Equator Mine (Quartz).*—See our VIIIth and Xth Reports, pp. 190 and 172. It is situated 3 miles S. of Diamond Springs, on Mathenas Creek, in T. 10 N., R. 11 E. Idle. Capt. T. Buckley, owner.

*Esperanza Mine (Quartz).*—See our Xth Report, p. 175. It lies in Sec. 28, T. 12 N., R. 10 E. Vertical double-compartment shaft, 10 by  $4\frac{1}{2}$  ft., inside of timbers, and 200 ft. deep. Steam hoist. About 300 ft. of levels have been run. The cross-cut at the "200" shows 64 ft. of low-grade ore between the walls.

*Esperanza South Extension (Quartz).*—Only assessment work and surface prospecting have been done.

*Eureka Mine (Quartz).*—It is in Georgetown, in T. 12 N., R. 10 E., and is 1,200 by 300 ft. Three parallel ore bodies having an N.E. and S.W. course are known. An incline shaft, 180 ft. deep on the main or center vein, showed 12 ft. of quartz. At 50 ft. depth a drift was run from the shaft and cut the E. vein. A small tunnel run on the W. vein exposed quartz 9 ft. wide. See our XIth Report, p. 203. Idle. E. B. Lee, of New York, owner.

*Faraday Mine* (Quartz).—See our VIIIth Report, p. 186. Idle.

*Flagstaff Mine* (Quartz).—See our VIIIth Report, p. 178. Idle.

*Fort Yuma Mine* (Quartz).—This mine is located on Dry Creek, 1 mile S.E. of the Big Cañon Mine. The vein is inclosed in black slate, which strikes N. and S., with a nearly vertical dip. Two claims have been located on the ledge, which is traceable for several thousand feet. The quartz has a ribbon character and varies from 2 to 3 ft. wide. A 10-stamp mill is located on the property. — Hale, of Omo Ranch, owner.

*French Claim* (Placer).—This property is situated on the seam belt, one quarter of a mile W. of Greenwood. The claim is 1,400 by 600 ft., and originally belonged to the California Water Company as a hydraulic. The crevices in the large pit of the former hydraulic are being worked; this pit is about 600 ft. long, 200 ft. wide, and about 80 ft. deep. The belt runs N. and S. and the quartz seams diverge in all directions, and carry the gold. The pit is estimated to have yielded \$500,000. A shaft sunk 45 ft. in the bottom of the pit proves the continuity of the vein downwards. The belt has been traced across from the North Fork to the South Fork of the American River. The gold is high grade, being worth \$20 26 per ounce. See our XIth Report, p. 204. L. Lechance, of Greenwood, owner.

*French Hill Mining Company's Mine* (Quartz).—Is 6 miles from Greenwood, in T. 13 N., R. 9 E., near Spanish Dry Diggings, and contains 160 acres in the porphyry seam belt, which here has a N.W. and S.E. course. The main quartz seam dips about 45° E., with an average width of 1½ ft., though attaining greater proportions in swells. The belt is excavated from 10 to 40 ft. in width. The workings are through a tunnel and an open cut; deep holes sunk by churn drills and exploded, throw large masses of rock into the cut, which are sluiced down to the mill 250 ft. below through 800 ft. of boxes 18 in. wide, paved with wooden blocks and set on grades varying from 8 in. to 2 ft. per box. The larger pieces of waste slate are gotten rid of by passing over a grizzly dumping into a neighboring ravine. By this method large amounts of ore are swiftly and cheaply delivered to the mill, which has 10 stamps of 750 lbs. weight, dropping 100 times per minute with a 5 in. drop and 8 in. discharge. The drop is arranged 1, 5, 2, 4, 3, feeding from No. 2. The battery is provided with an 8 in. plate on the inside and with No. 6 perforated sheet-tin screens. The aprons have an area of 52 in. by 12 ft., set on a grade of 1½ in. to the foot; below are quick-silver traps, blankets, and sluices with riffles. The plates are dressed every day, but only scraped once a week. The line of sluices to the mill and to the battery are cleaned up once a month. Power is derived from the Georgetown ditch, the water being used on a 6 ft. Pelton wheel, under 250 ft. of pressure. A. J. Johnston et al., of Sacramento, owners.

*Garden Valley Mine* (Quartz).—It is in the diorite, W. of Esperanza.

*Garfield Mining Company's Mine* (Quartz).—It is in T. 18 N., R. 11 E., about one fourth of a mile from Volcanoville, and contains 1,500 by 600 ft. The vein, in black slate, courses N. and S. and dips 55° W. near the surface, straightening up to 70° with depth. An incline shaft on the vein, 120 ft. deep, with a short drift near the bottom, exposes some pay ore. A tunnel, started at a point deeper than the bottom of the shaft, in running 700 ft. has cut several quartz stringers, but none of value. E. W. Chapman, of Greenwood, owner.



*Garfield and Excelsior Consolidated Gold Mine (Quartz).*—It is 1 mile N.E. of Greenwood and contains 3,000 by 600 ft., on the same course as the Idlewild Mine. A serpentine dike runs a short distance back of and parallel with the vein, which is in slate; the foot-wall is highly mineralized, the sulphurets carrying gold; the vein is 20 ft. wide. Of the four tunnels the uppermost, No. 1, is 275 ft.; No. 2, 325 ft.; No. 3, over 400 ft., and No. 4, 200 ft. in length; none of them have reached the ledge to date. The surface along the outcrop is gold-bearing, as are all the ravines heading toward it. Some ground-sluicing is being done. Free water under 200 ft. pressure for six months in the year can be obtained. F. G. Bilty et al., of Greenwood, owners.

*Garibaldi Consolidated Gold Mine (Quartz).*—It is three fourths of a mile from Greenwood, and embraces 3,000 by 600 ft. The vein courses N. 30° W., dips 55° N.E., in slate, with a width of 6 ft. No developments sufficient to establish the value of the property have been made. Mrs. Lee and J. Wolf, of Greenwood, owners.

*Gentle Annie Mine (Quartz).*—It is 1½ miles N. of Placerville, in Sec. 6, T. 10 N., R. 11 E., and comprises an area 1,000 ft. long by 1,500 ft. wide, and employs 18 men. The two parallel veins, from 50 to 80 ft. apart, course N. 30° W., with a dip of 70° to the E. They are from 10 to 40 ft. wide, between porphyry hanging- and slate foot-wall. The quartz is of ribbon structure, interstratified with black slate, carrying from 2 to 2½ per cent of sulphurets, mostly iron and galena.

The developments consist of two tunnels, one on mill level, 70 ft., and the other at the N. end of the claim, 400 ft. in length; both on the ore body. Below the mill-level tunnel are three winzes, from 10 to 40 ft. deep, all in ore. The working shaft intersects the tunnel about 500 ft. from the mouth, at 100 ft. depth, and continues 130 ft. below the same; it is partly incline, partly vertical. Eighty feet below the tunnel level a drift has been run N. from the shaft 130 ft., and about 200 ft. of ground has been stoped. A jackhead pump handles the water (about 2 miner's inches); the mine is run by a Green wheel operated with water from the El Dorado ditch, while a 12 horse-power steam hoist, situated at the intersection of tunnel and shaft, raises the ore to mill level. A "National" compressor, with Rand, Little Giant, and Slugger drills, is used. The mine is timbered throughout, using pine and spruce at a cost of 2 cents per running foot.

The reduction works consist of a 10-stamp mill, Challenge feeders, and 2 improved Frue vanners with 6 ft. belts, handling 1¾ tons per stamp per day, all run by a 4½ ft. Knight wheel under 160 ft. pressure, using 50 in. of water. The stamps weigh 750 lbs.; the speed is 100 drops per minute; the drop is 5 to 6 in.; the discharge 6 to 8 in., using a No. 40 punched sheet-tin screen. The mortars are wide and deep, and furnished with plates inside. The aprons are 52 in. wide by 3 ft. long, and set on a grade of 2 in. to the foot. The sluice plates are double, 12 ft. long, and are followed by four blanket sluices 6 ft. long and 14 in. wide, which are washed twice during a shift. The apron plates are only scraped once a month, though dressed twice a day; 40 per cent of the amalgam comes from these plates. See our Xth Report, p. 177. John Melton and G. B. Parlow, of Placerville, owners.

*Gold Note Mine (Quartz).*—See Philadelphia Mine.

*Golden State Mine (Quartz).*—This is 4 miles N.E. of Georgetown, and embraces 1,500 by 600 ft. of patented land. It is a belt containing

a network of quartz seams, worked from 200 to 300 ft. wide, with an N. and S. course. Aside from cuts, tunnels, and shafts made for prospecting purposes, the mine is worked through an open cut, the material being blasted down and washed through sluices. See our XIth Report, p. 204. W. Barklage et al., of Georgetown, owners.

*Gopher and Boulder Mine* (Quartz).—See our VIIIth Report, p. 175.

*Grand Victory Mine* (Quartz).—It is in Sec. 34, T. 10 N., R. 11 E., 7 miles S.E. from Placerville, on Squaw Creek, and comprises 160 acres. See our VIIIth and Xth Reports, pp. 194 and 178. The ore body is incased in slate, with an N.W. trend and nearly vertical dip, with a width of over 100 feet; the quartz seams are interstratified with the slate and with a black silicious rock, the whole carrying a large percentage of sulphurets, and also, it is supposed, selenium; the less decomposed and harder strata appear to carry the most free gold. Under the lately introduced cyanide process, working the decomposed portions of the ore, the yield has been largely increased, so it is reported. The developments in the mine consist of large pits sunk on the ore body, some of which are 60 feet deep and wide and several hundred feet long, connected near the bottom with the mill level through short tunnels. Grand Victory Mining Company, of Placerville, owners; M. B. Silver, Superintendent.

*Gray Mine* (Quartz).—See Old Gray Mine.

*Gray Eagle Cliff Mine* (Drift).—It is in Volcanoville, and contains 100 acres. The ancient channel has an E. and W. course, 300 ft. width, between slate rim rocks. The cemented pay gravel is from 2 to 4 ft. deep, with a capping of alternating strata of cement and gravel. It is worked through a tunnel starting at an outbreak of the gravel and run partly in bedrock. The gravel breasts are carried 50 to 60 ft. wide, and 5 ft. high, requiring very little timbering; ventilation is obtained through connection with old works. Three carloads of 1,500 lbs. each are taken out daily per man. The dump carries 1,000 carloads; washing being done once a week through 12 sluices set on a 16 in. grade, paved with slat and cross riffles. The wash water is obtained from the mines, using an old tunnel for a reservoir. The gold on the bedrock is coarse, and sells for \$18 per ounce. D. C. Webster, of Georgetown, owner.

*Greenstone Mine* (Quartz).—It is 2 miles E. of Shingle Springs. A considerable amount of work has been done here, as shown by several shafts; these were sunk in the serpentine. As no vein appears on the surface, the character of the ledge could not be ascertained. H. Barnes and L. L. Robinson, of Shingle Springs, owners.

*Griffith Mine* (Quartz).—See our VIIIth and Xth Reports, pp. 189 and 172. Idle.

*Griffith & Bryant Consolidated Mine* (Quartz).—It is in Sec. 30, T. 10 N., R. 11 E., one mile E. from Diamond Springs, and embraces 3,000 by 600 ft. The vein, 2 to 3 ft. wide, courses N. and S. A 140 ft. shaft on the vein has been drifted on to the N., and 50 ft. stoped. A 5-stamp "prospecting" mill, with 350 lb. stamps, driven by an 8 ft. "hurdy," under 60 ft. pressure, is part of the plant. C. F. Bryant, of Diamond Springs, owner.

*Grizzly Bear Mine* (Quartz).—See our XIth Report, p. 201.

*Grizzly Flat Mine* (Drift and Hydraulic).—This is in T. 13 N., R. 11 E., one half mile S.W. from Volcanoville, and contains 160 acres at the head of Grizzly Flat. A part of the surface has been hydraulicked,

showing the channel to have a N.E. and S.W. course. Tunnels have been driven into the hill to cut the channel, but so far without reaching it. Barklage Estate, of Greenwood, owners.

*Gross Mine (Quartz).*—See our VIIIth Report, p. 181. Idle.

*Grouse Gulch Mine (Quartz).*—It is  $1\frac{1}{2}$  miles W. of Grizzly Flat, on Grouse Gulch, and contains 1,500 by 600 ft. The vein courses N. and S., and dips  $60^\circ$  W., between syenite walls, varying in width from 6 in. to 5 ft. The ore is spotted; the narrower the vein the better the quality. A 100 ft. shaft is intersected at a depth of 60 ft. by a drain tunnel 200 ft. long. There is a second shaft higher up, 80 ft. deep, with a 50 ft. drift. No. 1 shaft has a 40 horse-power hoisting engine with a 6 in. Cornish pump. A third intermediate shaft is 50 ft. deep, from which good milling ore was obtained. See our VIIIth Report, p. 178. Mrs. K. Hoskins, of Grizzly Flat, owner.

*Halleck Mine (Quartz).*—See True Consolidated.

*Harmon Mine, Young and Old (Quartz).*—See True Consolidated.

*Havilah Mine (Quartz).*—See Nashville Mine.

*Hendy Mine (Quartz).*—See Nashville Mine.

*Henrietta Mine (Quartz).*—See our VIIIth Report, p. 186. Idle.

*Hope Mine (Placer).*—N.E. of Volcanoville. See our XIth Report, p. 206.

*Ibid Mine (Quartz).*—It is 1 mile S. of Grizzly Flat, in T. 9 N., R. 13 E. It is the southerly extension of the Mt. Pleasant Mine, 1,500 by 600 ft., and patented. C. W. Watts and T. D. Crocker, of San Francisco and Ohio, owners.

*Ida Mine (Quartz).*—Idle. See our VIIIth Report, p. 182.

*Idlewild (Taylor) Mine (Quartz).*—See our VIIIth, Xth, and XIth Reports. It is  $1\frac{1}{2}$  miles E. of Greenwood, on the "Mother Lode." The present workings are below the 600 ft. level, and since our last report the electric pumps have been replaced by others worked by compressed air, and the mill enlarged to 40 stamps. As the mine is troubled with swelling ground, the management have found it advisable to fill in the old stopes as much as possible, and for this purpose a chute has been opened to the surface, through which material dug from the surface is dropped, besides using the waste from the mine for the same purpose. In making the change to pumps run by compressed air, considerable annoyance was caused by their freezing up in less than thirty minutes after starting; this was remedied by introducing a small jet of water into the pipe above the suction.

The mill has 40 stamps of 950 lbs. weight, dropping 104 times per minute, using 4 in. chrome steel shoes and dies, that have an average life of 105 days, with a duty of 110 tons in twenty-four hours. The apron plate area is 52 in. by 16 ft., set at an angle of  $1\frac{3}{4}$  in. to 1 ft. The plates are dressed every day, but only scraped once a month; 38 per cent of the total yield of amalgam is taken from them, which might be increased if scraped oftener. The ore at present carries about 3 per cent sulphurets, saved on 8 Woodbury concentrators; a chlorination plant for working them is in contemplation. The power is derived from 45 in. and 6 ft. Dodd's wheels for mill and compressor; the latter to run five drills and the pumps. Electric lights are used all over the establishment. The ore carries considerable slate inclosed. Seventy-five men are employed; 50 underground. E. W. Chapman, of Georgetown, owner.



*Indian Creek Land and Mining Company's (Shaw) Mine (Quartz).*—This property has been described in our VIIIth and Xth Reports, pp. 193 and 181, and is situated  $2\frac{1}{2}$  miles W. of El Dorado, in T. 10 N., R. 10 E. It is 3,660 by 600 ft. on the west porphyry belt. The present company have a vertical shaft on the W. wall, taking their drift 8 ft. wide. It is from this part of the mine that their best pay rock is obtained. A drift is being run from a point 75 ft. deep in the 135 ft. vertical shaft on the E. wall. With large reduction works, the whole width between the walls (140 ft.) would pay to crush, but the capacity of the company's 5 ft. Huntington roller mill being 25 tons in twenty-four hours, only the higher grade quartz can be worked. The mill is supplied with 75 sq. ft. of plates and two Woodbury concentrators, that handle the  $1\frac{1}{2}$  to 3 per cent of sulphurets contained in the ore. A 12 horse-power steam engine is used, but water power under 135 ft. pressure could be obtained from the Crawford ditch. Very little timbering is required for the mine, and no artificial ventilation.

This deposit is one of the most peculiar and interesting to be found in the county. A dike of feldspar porphyry, 140 ft. wide at the mine, but narrowing from this point, can be traced for over 2 miles in a N. and S. direction, inclosed in black slate. The gold occurs mostly in a crushed zone on each side of this dike, although traces of the metal can be found over nearly its whole extent. In these crushed zones the original porphyry is more or less completely replaced by quartz, stringers of which extend in toward the center of the dike in a horizontal position. The stringers also extend out into the slates, but in the latter case they are vertical. The pure quartz is usually quite porous. Those portions of the dike where the replacement is not complete and which are filled with sulphurets, very closely resemble the ore of the Big Cañon Mine. Although gold in paying quantities is found nearly everywhere along the crushed zones, yet there are also many rich pockets. Much surface work has been done along the edges of this dike for half a mile N. and a mile and a half S. Indian Creek Land and Mining Company, owners; D. W. C. Morgan, of El Dorado, Superintendent.

*Inez (Central) Mine (Quartz).*—This property is situated 8 miles S. of El Dorado, in T. 8 N., R. 10 E., and is now idle. It is 1,500 by 600 ft. The vein strikes a little W. of N. on the east side of the main "Mother Lode" belt, and dips E. about  $60^{\circ}$ . Hanging-wall is slate, foot-wall is decomposed. A shaft has been sunk 250 ft. and is supplied with steam hoist. See our Xth Report, p. 171. Inez Gold Mining Company, owners; J. C. Healds, of Nashville, Superintendent.

*Ivanhoe Mine (Quartz).*—See our Xth Report, p. 175. It is said that this property will soon resume active work.

*Jerusalem Mine (Hydraulic).*—This property is situated  $1\frac{1}{2}$  miles E. of Placerville, where they are working a bench of gravel with three men. It is largely prospecting. — Alderson, of Placerville, owner.

*Josephine Mine (Quartz).*—See our VIIIth Report, p. 165. It is situated in Volcanoville, in T. 13 N., R. 11 E. It is idle. J. W. McCall et al., of Nevada City, owners.

*Kates (Norris) Mine (Drift).*—This property was formerly a part of the Mount Hope claim, and is situated  $1\frac{1}{2}$  miles E. of Volcanoville; it contains 80 acres facing on a ridge running down to the river. It was formerly worked as a hydraulic claim. The channel runs E. and W. Parts of this channel are eroded, only showing across the spurs that

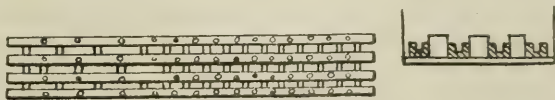
run N. and S. down the river. A tunnel has been driven S.W. for 250 ft. in the bedrock, then a 14 ft. upraise made into the channel. The gravel is strongly cemented, necessitating the use of stamps for reduction. The gangway is being extended 100 ft. S. P. Kates et al., of Georgetown, owners.

*Kentucky Flat Gravel Mine* (Drift).—This property is in Sec. 22, T. 13 N., R. 11 E., 9 miles E. of Georgetown, and contains 154 acres. The channel courses N. 30° W., which is also the course of the main tunnel, extending 650 ft. From this tunnel an 18 ft. upraise breaks into the gravel, in which a drift has been extended for 700 ft. in length, from which openings have been made in gravel to the N. 150 ft., to the W. 80 ft., and to the E. 25 ft. The gangway is carried 6 ft. high, and the gravel is drifted from 3 to 5 ft. in depth. The gravel is mostly quartz of a deep blue color; some of the boulders being over 9 ft. in length and breadth; the whole is slightly cemented. The altitude of the bedrock is 3,130 ft. Just above the gravel is a layer of hard sand from 3 to 4 ft. thick, between which and the cement, logs, charcoal, and petrified wood are frequently found. The bedrock tunnel is only partially timbered, and no artificial ventilation is required. Little water comes from the gravel; the wash water is obtained free from the neighboring gulches; the washing being effected through seven or eight boxes supplied with slat and block riffles. A second body of gravel of a gray color has been uncovered parallel to the blue, but on a higher bench. The bedrock is slate and serpentine; the gold is coarse and is .910 fine. A. J. Wilton, of Georgetown, owner.

*Knob Hill Mine* (Quartz).—In past years this mine was actively worked, but at present it is idle. It lies on the N. side of Agra Mountain.

*La Moille Mine* (Quartz).—This property is situated at Logtown, 3 miles S. of Mud Springs, and comprises 1,500 by 600 ft. It carries a number of quartz seams in granite, with a general N. and S. course. H. Sutcliffe, of Mud Springs, owner.

*Linden Mine* (Drift).—See our VIIIth Report, p. 196. They have three claims, comprising 300 acres, known as Cedar Springs, Linden, and Globe claims. The present work of drifting on this gravel deposit is carried on through a bedrock tunnel running S. of E. 4,000 ft., which crosses a 500 ft. channel below the tunnel level, and continuing, cuts the channel again, showing a horseshoe bend. The gravel breasts are carried 30 ft., and from 2½ to 8 ft. deep, timbered with square sets and



RIFFLE USED AT LINDEN MINE, ELDORADO CO.

lagged. The main drift is timbered with 6 ft. posts and 3½ ft. caps, in the clear. The ventilation is through an air shaft 90 ft. deep, and air gangways. The channel is capped with lava about 120 ft. thick. The company employs 23 men on two shifts, taking out 40 carloads per day. The gravel is run through a 10-stamp mill, being somewhat cemented, and carrying a large proportion of clay; hence the use of 8 in. of water through the battery. The stamps are light, being 500 lbs., drop-

ping 105 times per minute, with a 7 in. drop. The battery has a double discharge, using wire screens, 16 holes to the square inch; the apron is provided with four grooves. The pulp passes into sluices provided with slat riffles, with alternating small, projecting blocks between the slats. In the slats, between the projection, auger holes are bored, the current thus receiving a serpentine course; 400 feet of sluices are provided. No regular time is set for cleaning up the boxes; it depends entirely on the accumulation of amalgam. The mill puts through 75 carloads per day, weighing 1,800 lbs. each. Linden Gold Mining Company, of Placerville, owners; J. M. Brown, Superintendent.

*Little Chief Mine* (Placer).—It is on Cañon Creek above Georgia Slide, on the porphyry seam belt. Two tunnels are run, 130 ft. and 240 ft. long, and upraises made on the seams. A one-stamp Kendall mill, run by 4 ft. Pelton wheel, with 5 in. of water under a 100 ft. head, crushes the quartz out of the seams. Most of the seams pitch to the S. Beattie Bros., of Georgetown, owners.

*Live Oak Mine* (Quartz).—This is an undeveloped property. It lies about  $1\frac{1}{2}$  miles S. of the Big Cañon Mine. The ore body has an exposed width of 200 ft., and in general character much resembles the latter mine. It lies between massive greenstone and slate.

*Log Cabin Mine* (Quartz).—It is in Sec. 30, T. 9 N., R. 10 E., about 5 miles S. of Shingle Springs, and is 1,500 by 600 ft. The vein strikes S.E. and N.W., dipping to the N. between slate walls 4 ft. apart. Two tunnels have been run by the owner to cut the ledge, without yet reaching it. No. 1, 65 ft. below the croppings, is 130 ft. long, and No. 2, 35 ft. lower, is 170 ft. long; both on S.W. course. Worked by the owner alone. J. Darrow, of Shingle Springs, owner.

*Lone Jack Mine* (Quartz).—See our Xth Report, p. 176. It is in Sec. 28, T. 12 N., R. 10 E. Steam hoist on a shaft 400 ft. deep. Ledge about 24 ft. wide.

*Lone Star Mine* (Quartz).—This property is situated 2 miles E. of Diamond Springs. It is 1,500 by 600 ft., with a vein from 4 to 5 ft. wide, running N.W. and S.E. between slate walls, decomposed next to the vein. The quartz forms in lenticular or kidney-shaped masses in the vein; dip nearly vertical. A tunnel has been started on Bangor Gulch about 600 ft. E. of the main quartz belt. A. Latourrette, J. B. Lawton, and A. Tirre, of Diamond Springs, owners.

*Lone Star Mine* (Quartz).—It is in Big Cañon, in T. 8 N., R. 10 E.,  $1\frac{1}{4}$  miles S. of Nashville; it is 1,500 by 600 ft. The vein strikes N. and S. and dips E. about  $60^\circ$ . The walls are slate, with a heavy gouge 1 ft. wide on the foot-wall. A shaft has been sunk 100 ft. deep and a drift run S. about 100 ft. on a 7 ft. ledge of ribbon quartz carrying about 0.5 per cent of sulphurets. The hoisting is done with a windlass. A 5 ft. Huntington mill, run by steam, crushes from 12 to 14 tons per day, consuming one cord of wood, costing \$4. J. C. Heald, of Nashville, owner.

*Lookout Mine* (Quartz).—This property is in T. 13 N., R. 11 E., in Quartz Cañon, near Volcanoville. The claim is 4,500 by 600 ft. The vein lies between slate walls, with an average width of 2 ft. A cross-cut tunnel running for the ledge has been driven 200 ft. W. Cary, of Georgetown, owner.

*McCall Gravel Mine* (Drift).—It is 3 miles N.E. of Volcanoville, on the S. side of the Middle Fork of the American River. It is a bench of



50 ft. above the present river level, that has been worked since the early '50s. It carries regular river-wash and channel gold. A slate bedrock tunnel 300 ft. in length runs under the gravel, which is free, requiring square sets in breasting out, using 5 ft. posts. The gold is worth \$18 per ounce. T. McCall, of Michigan Bluff, owner.

*McNulty (Oakland) Mine* (Quartz).—It is in T. 9 N., R. 10 E., 4 miles S. of El Dorado, and contains 80 acres. The vein courses N. and S.; dips E. about 60°, and is 6 ft. wide, with a slate hanging- and greenstone foot-wall. The main tunnel is 300 ft. long, and the shaft is sunk 600 ft. below it, the hoisting power being furnished by a Knight wheel in the tunnel, with water from the Crawford ditch. J. B. Drury, of St. Louis, Mo., owner.

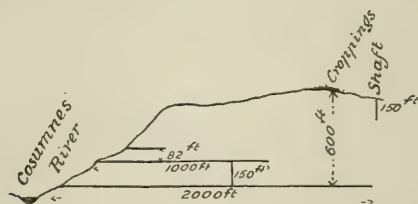
*Madrona Mine* (Quartz).—It is in Sec. 29, T. 12 N., R. 10 E. Shaft 40 ft. deep. Vein of unknown width and low grade, but carries a large percentage of sulphurets, and is inclosed in slate walls.

*Mammoth Mine* (Quartz).—See our VIIIth Report, p. 186.

*Manzanita Queen Mine* (Quartz).—See our VIIIth and Xth Reports, pp. 189 and 172.

*Mathenas Creek Mine* (Quartz).—See our VIIIth and Xth Reports, pp. 190 and 172. The company owns half a mile on the course of the ledge, one quarter mile wide, that lies just W. of the "Mother Lode." The course of the vein is N. 20° W., and dips 55° to the E., and is from 2 to 8 ft. wide between slate walls. A tunnel is being driven from near the creek to cut two veins that crop out on the surface, at a depth of 300 ft. The ground requires but little timbering. The main vein carries 0.75 per cent of sulphurets, assaying several hundred dollars per ton. The mill (Huntington) stands at the junction of Stone and Mathenas creeks, 100 yds. W. of the tunnel. Four men are employed. Sacramento Development Company, owners; R. T. Morrison, of El Dorado, Superintendent.

*Melton Mine* (Quartz).—See our VIIIth Report, p. 177. It is  $2\frac{1}{2}$  miles S.E. of Grizzly Flat, and is being reopened after an idleness of six years. There are three claims of 1,500 by 600 ft., each carrying a N. and S. vein,



SECTION OF MELTON MINE, EL DORADO CO.

with a slight dip to the W. and an E. and W. vein dipping N. The country rock is a syenite. Aside from the old plant it is proposed to build a 3-ton chlorination plant to work the sulphurets. L. L. Lamborn, of Grizzly Flat, owner.

*Miller Mine* (Quartz).—See our VIIIth and Xth Reports, pp. 189 and 172.

*Mississippi Mine* (Drift).—It is  $1\frac{1}{2}$  miles E. of Volcanoville, between the Kates and Gray Eagle claims. It contains 80 acres. A bedrock tunnel is run 240 ft. in the W. side of the spur; the others have been run

from the E. In this claim a top layer of free gravel is being worked; the bottom (channel) gravel, which is cemented, has not been touched. C. F. Lloyd, of Georgetown, owner.

*Montezuma Mine* (Quartz).—This property is in T. 8 N., R. 10 E. It controls 1,500 by 600 ft. on the main "Mother Lode," opposite Nashville. The vein on the S. end is 12 ft. wide, between slate walls; going N. this reduces to about 6 ft. The ribbon quartz carries about 1 per cent of sulphurets. A shaft has been sunk on the vein about 350 ft.; the mouth at present is caved. A new shaft has reached a depth of 160 ft., and is supplied with a steam hoist and a Dow pump, consuming one cord of wood per day. About 60 feet of drift have been run S. from the new shaft. There is a 10-stamp (650 lbs.) mill, with aprons 5 by 6 ft.; 4 sluice plates 15 ft. long by 16 in. wide, set on a grade of  $1\frac{1}{2}$  in. to the foot. Also 20 ft. of blanket sluices. The quartz is variable, ranging from \$2 50 to \$15 per ton. The mill is run by free water, acting through 2 miles of ditch. J. C. Heald, of Nashville, owner.

*Mooney Mine* (Drift).—Is 8 miles E. of Placerville. Active development commenced in summer of 1894.

*Morey Mine* (Quartz).—This property is situated on Humbug Flat, 1 mile W. from Grizzly Flat. There are two claims in the property, one showing an N. and S. vein; the other with an E. and W. one. The former dips nearly vertical, the latter to the N. The veins are in syenite and have an average width of 2 ft. The quartz is of good grade, carrying lead, iron, and zinc sulphurets. The property is opened through tunnels and a shaft. On the N. and S. vein the tunnel has a length of 300 ft., and on the E. and W. vein 400 ft. The shaft is down 125 ft., or 50 ft. below the tunnel level. The ore between the tunnel and the surface has been stoped. A small 5-stamp mill, with 600 lb. stamps, is worked by a Knight wheel under 100 ft. pressure; the water (60 in.) is supplied from the Eagle ditch, at a cost of \$1 per twenty-four hours. The apron plate is 4 by 6 ft., set on a grade of  $1\frac{3}{4}$  in. to the foot. The duty per stamp, when using a No. 40 punched screen, at 90 drops per minute, is  $1\frac{1}{4}$  tons. Half the amalgam is saved in the battery, which is provided with an inside plate. The aprons are scraped two or three times in twenty-four hours. The gold is worth \$13 per ounce. See our VIIIth and Xth Reports, pp. 178 and 178. E. R. Morey, of Grizzly Flat, owner.

*Morse Mine* (Quartz).—This mine is located 3 miles E. of Latrobe, on the W. side of a large body of serpentine which crosses Big Cañon and extends S. to the Cosumnes River. An incline shaft has been sunk here and the hoisting works still remain, but nothing could be learned as to the extent and character of the ore.

*Mount Hope Mine* (Drift).—See Kates Mine.

*Mount Pleasant Mine* (Quartz).—It is three fourths of a mile W. from Grizzly Flat. The company controls one mile on the vein, which strikes N. and S. in syenite, with a width of from 2 to 6 ft. The old workings extend down 700 ft.; these are filled with water to the drain tunnel level, which cuts the shaft 125 ft. below the surface. Two known ore shoots have a southerly pitch. A 10-stamp mill (originally 20), run by steam power, with 4 Frue concentrators, is idle. See our VIIIth and Xth Reports, pp. 178 and 178. Mount Pleasant Gold Mining Company, owners; L. Missmore, Superintendent.

*Murzo Mine (Brass's Claim) (Drift).*—This property is on Buckeye Hill, on Middle Fork of American River, in T. 13 N., R. 10 E., 2 miles from Volcanoville, and contains 30 acres. A tunnel has been run 150 ft. through the slate rimrock, showing the bedrock to be pitching away. A second lower one has been started, with three men working. This claim is adjoining, and working on the same channel as the Buckeye Hill gravel claim. A. E. Brass, of Georgetown, owner.

*Nashville (Havilah or Hendy) Mine (Quartz).*—It is situated at Nashville, in T. 8 N., R. 10 E. The works, which were very extensive, were established on a large quartz cropping on the "Mother Lode"; it contains 1,500 by 600 ft. The shaft is said to be 650 ft. deep, and at 200 ft. depth the characteristic black gouge of the vein is given as 12 ft. wide. The mine has not been worked for eight years, but is now (September, 1894) being rehabilitated by an English company. Joshua Hendy Machine Works, of San Francisco, owners.

*New El Dorado Mine (Quartz).*—It is  $2\frac{1}{2}$  miles N. from Greenwood, and contains 1,500 by 600 ft. It is the north extension of the Cedarberg Mine. The vein strikes N. and S. and dips E. It carries specimens of very coarse gold, and has been opened by a tunnel. W. N. Martin, of Oakland, owner.

*Oak Mine (Quartz).*—It is 5 miles S.W. of Grizzly Flat. The claim is 3,000 by 600 ft. The vein, from 1 to 4 ft. wide, courses N.E. and S.W., dipping W. at an angle of  $75^\circ$ , between granite walls. The quartz carries considerable sulphurets. The main tunnel runs on the vein 400 ft.; another on a higher level is driven 150 ft., and from this to the surface the ground is stoped out. A 5-stamp water power mill, with 800 lb. stamps, and a 16 ft. buddle, crush and concentrate the ore. J. Ryan, of Grizzly Flat, owner.

*Ohio Mine (Quartz).*—It is 1 mile S.W. from Grizzly Flat, in T. 9 N., R. 13 E. The claim is 1,500 by 600 ft., and forms the south extension of the Mount Pleasant Mine. The vein averages about 4 ft. in width. Two shafts have been sunk on the vein; an inclined and a vertical one; the latter is 135 ft. deep. An ore shoot from the Mount Pleasant ground pitching S. has been worked for several hundred feet in length on the Ohio ground to a depth of 50 ft. The ore is said to have milled \$12 per ton, though there are spots in the vein rated at \$60, exclusive of the sulphurets, of which there is about 1 per cent, assaying from \$60 to \$200 per ton. On Steely's Fork of the Cosumnes River is a 5-acre millsite belonging to the property.

*Ohio Mine (Quartz).*—This property is half a mile from Greenwood, in Georgetown District. The claim consists of 1,200 by 600 ft., on a 4 ft. vein coursing a little N. and W., with a northerly dip between slate walls. The developments consist of open cuts and surface washings. S. Kaiser, of Greenwood, owner.

*Old Gray Mine (Quartz).*—It is in T. 10 N., R. 9 E., 3 miles N.W. from Shingle Springs, and is 2,000 by 600 ft. The vein runs E. and W.; dips N. about  $45^\circ$ , and is from 1 in. to 3 ft. wide. It is a pocket vein, and is on the edge of a great body of gabbro. There is a shaft 100 ft. deep, with a short drift on the pay shoot, where the vein is 3 ft. wide. D. C. Hodgkins, of San Francisco, owner.

*Oregon Mine (Quartz).*—See our VIIIth Report, p. 182. North extension of the Rose.



*Oriflamme Mine* (Quartz).—See our VIIIth and Xth Reports, pp. 189 and 172.

*Oro Fino Mine* (Quartz).—See Big Cañon Mine.

*Pacific Mine* (Quartz).—See our VIIIth, Xth, and XIth Reports, pp. 183, 173, and 203. It is situated in Placerville. Abandoned.

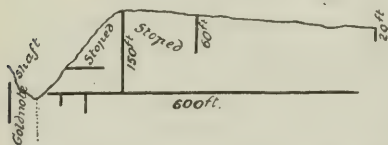
*Pacific Mine* (Placer).—This property is situated near Georgia Slide, on Cañon Creek, in T. 12 N., R. 10 E. It contains between 6 and 7 acres on the porphyry seam belt. The workings consist of an open cut; the banks being blasted down and the entire mass washed through a long line of sluices with block riffles. Barklage Estate et al., of Georgetown, owners.

*Padre Mine* (Quartz).—It is  $2\frac{1}{2}$  miles N. from Nashville, in T. 8 N., R. 10 E., and is 1,500 by 600 ft. on the "Mother Lode"; the quartz is 5 ft. in width. A shaft on the vein is 160 ft. deep, supplied with water-power hoist, using a home-made wheel under 23 ft. head. A 5-stamp mill, with 650 lb. stamps, run by water power, belongs to the property. Not working. J. M. Vandergrift, of Nashville, owner.

*Parson Mine* (Seam).—See our XIth Report, p. 203.

*Payne Gravel Claim* (Drift).—It is in T. 9 N., R. 13 E., 3 miles S. of Grizzly Flat, and consists of 50 acres south of Clear Creek. It is capped with 40 ft. of lava; pay gravel from 1 to 3 ft. deep on slate bedrock; the gold is coarse. A tunnel started in the gravel has been driven 200 ft. No breasting has been done yet. The drift is timbered with 6 ft. 4 in. posts and 3 ft. 6 in. caps, in the clear, and with a 5 ft. spread. Wash-water is obtained from Clear Creek. There is a bedrock race and six flume boxes for washing, using slat riffles. A clean-up is made twice a year. The channel has a S.E. and N.W. course; its width has not been ascertained. J. M. McClean, of Grizzly Flat, owner.

*Philadelphia and Gold Note Mine* (Quartz).—It is 8 miles S. of Grizzly Flat, in T. 8 N., R. 18 E. It lies at an elevation of nearly 4,000 ft. above sea-level, and is 2,900 by 600 ft. The course of the vein is N. 30° W., with an easterly dip at an angle of about 60°; the average width between walls is 4 ft. The hanging-wall is a micaceous slate; the foot-wall talcose, with a black gouge, from 1 to 2 ft. wide. Two shafts have been sunk, one 150 ft.



SECTION OF GOLD NOTE & PHILADELPHIA MINES, ELDORADO CO.

and the other 60 ft. deep. A tunnel 600 ft. long connects with the deeper shaft; below are two winzes, 17 ft. and 35 ft. deep; the former 25 ft. and the latter 75 ft. from the mouth of the tunnel. The ore shoot is 600 ft. long, and about 100 ft. have been stoped; the pitch appears to be to the N. The property is well supplied with water and timber; lumber is procured from Tower's mill, 12 miles distant, at a cost of \$10 per 1,000 ft. Not more than a miner's inch of water issues from the tunnel. The quartz has a ribbon structure, carrying about  $2\frac{1}{2}$  per cent of sulphurets, mostly iron, with some galena; they are said to assay from \$20 to \$300 per ton. The ore is reduced in a 10-stamp mill with 650 lb. stamps. The stamps make 87 drops per minute, starting with 4 in. drop with new shoes and dies, and increasing with the wear of the shoes and dies to 7 in.; the discharge varies from 2 to 7 in. high. Three quarters of a ton is crushed per stamp through

a No. 40 tin screen. Cast-iron shoes and dies are used. The aprons are 4 by 4 ft.; the sluice plates (double) 12 ft. long and 14 in. wide, all set on an angle of 2 in. to the foot. The feeding is done by hand. The tailings are concentrated on a 16 ft. buddle. The mill is run by water power; the water is from the Plymouth Company's ditch, and applied to a 8 ft. home-made "hurdy" wheel. Polk, Parker Bros. & Chapman, of Omo Ranch, owners.

*Pine Hill Mine* (Quartz).—It lies one half mile to the E. of the Pyramid, on an E. and W. vein. The formation is much the same as at the Pyramid.

*Pine Hill Gold Mining Company's Mine* (Quartz).—Its property is 6 miles N. from Shingle Springs, and is 3,000 ft. in length on an E. and W. vein, by 300 ft. in width. The vein is 30 ft. wide, between slate walls, and carries 5 per cent of sulphurets (iron, lead, zinc, and copper). An incline is sunk on the vein about 30 ft., and a cross-cut started for the hanging-wall; at present it is in 30 ft. and has not reached the wall. Pine Hill Gold Mining Company, owners; C. Milly, of Shingle Springs, President.

*Pleasant Valley Gravel Channel*.—A rich channel of drift gravel was discovered in the fall of 1893, running E. and W. under Pleasant Valley, 10 miles E. of Placerville. It is covered by the ranches of John Fink and N. Avansino, and is about 60 ft. beneath the surface. Dimensions and richness undetermined. Is being actively prospected. An 8-stamp mill is being erected by Mr. Fink.

*Pocahontas Mine* (Quartz).—It is 2 miles S. from El Dorado. It is 1,500 by 600 ft. on a N.W. and S.E. vein, which is 4 ft. wide, with an easterly dip, on the contact of granite and slate; the latter makes the hanging-wall. To resume soon.

*Pyramid Mine* (Quartz).—This mine, the property of the Pine Hill Gold and Silver Mining Company, is situated 5 miles N. of Shingle Springs. The claim lies on a hill from the summit of which rises a great body of quartz. Before being blasted off this mass of quartz extended fully 25 ft. into the air. Several veins unite to form this "blowout," as the miners term it, in the center of the claim. The main vein does not extend far S., but can be traced several miles to the N. Much of the quartz is white and massive. The ore is rather base, carrying a little galena with arsenical, copper, and iron pyrites. The gold is partly contained in these sulphurets and partly free. The inclosing walls are talcose schist. A small amount of mariposite is found in the lower workings. The same company owns the Unity, the extension of this claim on the N. A method of roasting the ore has lately been undertaken here, so as to save a greater proportion of the gold, but it has not yet been very successful.

The mine is opened by a tunnel 300 ft. long on the vein, giving about 100 ft. backs; 135 ft. from the tunnel mouth a shaft 100 ft. deep has been sunk and a drift run N. 140 ft. on the pay shoot.

The shaft is provided with a fan ventilator and steam hoist (30 horsepower). The tunnel track is iron "T" rails, 12 lbs. to the foot. A 5-stamp steam mill with 750 lb. stamps and two Frue concentrators, arranged to run by water part of the year, reduces ore. The mine makes 2,000 gallons of water per day, which is hoisted to the tunnel level. The course of the vein is N. 27° E. Pyramid Mill and Mining Company, owners; W. H. Harvey, of Shingle Springs, Superintendent.

*Rattler Mine (Quartz).*—It is  $2\frac{1}{2}$  miles S. from Placerville, in T. 10 N., R. 11 E., and is a small claim of 900 by 300 ft., supposed to be on the same vein as the Epley, on the opposite side of Weber Creek; it has two tunnels. John Dench and James Keyser, of Placerville, owners.

*Red Rover Gold Mine (Quartz).*—It is 3 miles S.E. of El Dorado, in T. 10 N., R. 9 E. It is 1,500 by 600 ft., on a N. and S. vein, from 6 in. to 3 ft. wide, dipping N.  $60^{\circ}$  E., with granite hanging- and slate foot-wall. Two shafts are sunk on the vein, 130 ft. and 30 ft. deep, and 75 ft. apart, with drifts 85 ft. to the N. and 30 ft. to the S. E. Harper et al., of El Dorado, owners.

*Revenge Claim (Quartz).*—This property is situated in T. 13 N., R. 9 E., 1 mile S. of Greenwood. Idle. J. Cheney, of Philadelphia, owner.

*Ribbon Rock Mine (Quartz).*—It is in Sec. 20, T. 10 N., R. 11 E.,  $2\frac{1}{2}$  miles S.E. of Placerville, in Scott's Ravine, and is 1,500 by 600 ft., on a 4 ft. vein between slate walls running N.  $12^{\circ}$  W., with a dip to the E. of  $65^{\circ}$ . This is supposed to be on the main "Mother Lode." Two shallow shafts, 23 and 36 ft., show a good vein, with heavy gouge on the foot-wall. The quartz is of ribbon structure, and carries about 1 per cent of sulphurets. M. Miller, of Placerville, owner.

*Rocky Bar Claim (Quartz).*—It is half a mile E. of Greenwood, and is 1,500 by 600 feet on a N.W. vein, about 1 ft. wide between slate walls, and has an easterly dip of about  $60^{\circ}$ . Two shafts (now caved) have been sunk, the deepest said to be 45 ft. Also an extended cut has been made along the croppings. The slate next to the walls is well mineralized. S. Kaiser, of Greenwood, owner.

*Rodgers' Mine (Drift).*—See Benfield.

*Rose Mine (Quartz).*—See our VIIIth Report, p. 182. It lies in the slate, W. of the Pacific Mine, at Placerville.

*Rosencranz Mine (Quartz).*—See our VIIIth and Xth Reports, pp. 171 and 176.

*San Martine Gold Mine (Quartz).*—It is  $1\frac{1}{2}$  miles N. of Greenwood, and is 1,500 by 600 ft. The veins, which lie in the slate near the serpentine, run N.W. These small quartz seams are being sunk upon. An incline of 23 ft., sunk on a veinlet from 1 to 6 in. wide, yields rich in places; the rock is worked in a 9 ft. "hurdy," under a 20 ft. head, requiring 10 in. of water. E. Hummel, of Greenwood, owner.

*Santa Rosa Mining Claim (Drift).*—This property is situated on Hopkins Creek, near Volcanoville, and controls 480 acres of ground. A bedrock tunnel is being driven by two men, and at present is 713 ft. in length. From this an upraise for air will be made into the old Bunker Hill channel, which crosses the course of the tunnel at nearly right angles. The channel that the tunnel is designed to tap lies about 1,000 feet farther back in the hill. The bedrock is hard slate, requiring no timbering. A blower run by a small Turk wheel, 16 in. in diameter, is used to clear the tunnel of smoke. Water power is derived from springs near by. Santa Rosa Drift Mining Company, owners; G. A. Tupper, of Santa Rosa, Secretary.

*Schleifer Mine (Quartz).*—This mine is on the E. side of Big Cañon, 7 miles S. of Shingle Springs. A ledge was opened here for iron, but the quality proved too poor. The only mineral to be found around the old workings is a base sulphide ore, said to carry some gold. The country rock is much broken up by bunches of porphyry.



*Sharp Mine* (Quartz).—See our VIIIth Report, p. 194. A 10-stamp mill was erected in 1890 and run a short time. Now idle.

*Shaw Mine* (Quartz).—See Indian Creek Land and Mining Company.

*Slager Mine* (Quartz).—This property is situated 4 miles N. of Greenwood, and has 600 by 600 ft. of patented ground; the remainder of the claim is held by possessory right. The vein, about 20 ft. wide between slate walls, talcose on the foot, is on the course of the "Mother Lode," with a N.W. course and an easterly dip. The developments consist of a tunnel 500 ft. long; the tunnel taps a shaft 250 ft. deep. In and above the tunnel, on the pay shoot, for 300 ft. in length, the vein has been stoped to the surface. John Wade et al., of Oakland, owners.

*Spanish Mine* (Hydraulic).—This property is situated half a mile N.W. from Greenwood, and is on the "seam" belt; the claim has 1,500 by 600 ft. of patented ground. Eruptive dikes traverse the slate bed-rock, and numerous quartz seams penetrate the slate. In all of the different varieties of rock gold has been found; among these, besides different slates, were amygdaloidal porphyritic rocks, clays, and quartz. The larger body of quartz (broken up) crosses the pit between slate walls. A shaft was sunk on this 45 ft. and yielded considerable gold. The whole has been worked by hydraulic process, but at present two men are working on the seams, panning out the quartz. M. M. Howe, of Greenwood, owner.

*Springfield Mine* (Quartz).—See our VIth Report (Part II).

*Staples Claim* (Quartz).—It is situated in Logtown,  $2\frac{1}{2}$  miles S. of El Dorado. It is 1,500 by 600 ft. Prospecting on small quartz stringers in the granite.

*Standard Pocket Mine* (Quartz).—It is a quarter of a mile N. from Coloma, across the South Fork of the American River, and is 1,500 by 600 ft. It belongs in the seam diggings belt near the contact of slate with granite. The course is N.W. A tunnel has been driven 230 ft. The seams run 2 to 12 in. in width, and all carry more or less gold. Idle. C. Schulze and G. Patrick, of Coloma, owners.

*Starlight Mine* (Quartz).—This property is situated in T. 9 N., R. 10 E., 2 miles S. of El Dorado, and W. of Logtown, and is 500 by 600 ft. The vein courses N., dipping E. about  $40^\circ$ . There are three shafts sunk on the vein; the most northerly is about 160 ft. deep; 300 ft. to the south is a second (incline) shaft, about 175 ft. deep, which is tapped near the bottom by a tunnel over 500 ft. long, running on the vein; still 300 ft. farther south is a shaft 350 ft. deep, which is tapped by a tunnel 160 ft. long, and has a drift 110 ft. Drifts and cross-cuts have been run at the 60 ft. level, 100 ft., 160 ft., and 270 ft. long. The present workings are being carried on to the north of the middle shaft. Starlight Mining Company, owners; A. Blanc, of El Dorado, Superintendent.

*Stewart Mine* (Drift).—See Xth Report, p. 180. It is  $1\frac{1}{2}$  miles S.E. of Placerville, between Chili Ravine and Weber Creek. It is provided with a 10-stamp double-discharge mill. It has been worked intermittently for years with indifferent success. Recently some rich gravel was struck and its future is brighter. John Melton, of Placerville, owner.

*St. Lawrence Mine* (Quartz).—Seven miles N. of Placerville. See our XIth Report, p. 202. Myerson & Alderson, of Placerville, owners.

*St. Lawrence (Stillwagon) Mine* (Quartz).—This property is situated 7 miles W. of Fairplay. It comprises two claims, each 1,500 by 600 ft. The vein, from 2 to 3 ft. wide, between granite walls, has a N.E. strike

and dip to the S. The quartz carries a large per cent of sulphurets. Both claims are opened by tunnels on the ledge. No. 1, or the Still-wagon, has a 400 ft. tunnel, and No. 2, the extension, has a 200 ft. tunnel. On the former a little stoping has been done. A 5-stamp mill, to be run by water power, is being built; using 850 lb. stamps and a Woodbury concentrator. The motive power is a 6 ft. Knight wheel, worked under a 70 ft. head. The compressor, for one Burleigh drill, is run by a 4 ft. Knight wheel. The company own their own power; 250 miner's inches are taken from the Little South Fork of the Cosumnes River through three quarters of a mile of ditch. A blower will be put on for ventilation. Apron plates are 4 by 6 ft., with a grade of 1 in. to the foot. Timber is abundant on the ground. Freight to the mine from Placerville is 50 cents per cental. See our Xth Report, p. 178. S. A. Laine, of Grizzly Flat, owner.

*Stuckslager Mine (Quartz).*—It is situated on Granite Creek, 1 mile S.W. of Lotus or Uniontown. This claim is noteworthy for the presence of roscoelite, a very rare mineral, with the gold; this mineral was first discovered here. The vein is about 1 ft. wide, and has a N.E. course, dipping southerly about 60°. The fissure is near the contact of the granite and the serpentine; the roscoelite fills fine seams near the face of the walls. A tunnel has been started in the wall and runs 525 ft. along the ledge, and is connected with the surface by an upraise of 225 ft.; a winze is sunk 40 ft. below the level of the tunnel. The two men working here crush the richer specimens in hand mortars. Across the river the same roscoelite-bearing fissures have been found. C. H. Grube and W. B. McKinny, of Lotus, owners.

*Sugar Loaf Mine (Quartz).*—It is on the western side of Logtown Divide, about 6 miles S. of El Dorado. Years ago a 20-stamp mill was in operation here. The ledge is large, consisting of massive white quartz often crystallized. The gold is not often disseminated through it, but appears in pockets. It has been developed by tunnels and shafts, now caved in. The ledge is on the contact between the diabase forming the divide and the belt of slates so prominent in Big Cañon.

*Sunday Mine (Quartz).*—It is  $1\frac{1}{2}$  miles W. of Grizzly Flat, and is 1,500 by 600 ft., on a N. and S. vein parallel with the Grouse vein, varying from 10 in. to 3 ft. in width, between syenite walls. Developments on the mine consist of a shaft 110 ft. deep, with an 80 ft. drift; the ground to the surface has been stoped. The vein is 22 in. wide and heavily sulphuretted. The shaft is furnished with a horse-whim and Cornish pump. On the hill above the shaft is a 300 ft. tunnel, exposing a vein from 1 to 3 ft. wide. Mrs. M. Jeffrey et al., of Grizzly Flat, owners.

*Superior Mine (Quartz).*—See our VIIIth and Xth Reports, pp. 187 and 172. W. H. Martin, of Crocker Building, San Francisco, owner.

*Taylor Mine (Quartz).*—See Idlewild Mine.

*Texas Hill Mine (Drift).*—This property is 2 miles E. of Placerville, and controls one mile of the channel, which is worked through a tunnel 1,500 ft. long, ending in a 75 ft. incline. The channel is crossed by the tunnel first 100 ft. from the mouth, and again in the end, showing the works to be in a bend in the ancient river. There are two gangways, one to the N. and the other to the N.W. The breasts are carried 100 ft. wide and 4 ft. high; full sets of timber are required, as the roof is in many places sand; no pipe-clay. The bedrock is porphyry. Ventilation is by lower tunnel, but connection will soon be made with an air

shaft now 157 ft. in depth. The gravel is capped by lava 120 ft. thick. Pay gravel, 1 to 3 ft. deep, slightly cemented. The general course of the channel is N.W. About 25 per cent of the mass is cobbles and boulders. Every "breaster" takes out daily 10 carloads of gravel of 1,600 lbs. weight; cost of recovery of gold per carload is given at 40 cents. The gold is coarse and sells for over \$19 per ounce. The 10-stamp mill, with 750 lb. stamps, has a duty of 75 cars per day; the stamps make 95 drops per minute. Steel wire screens with five holes to the inch, and 8 in. of water, are used in the battery. The mill is run by a Knight wheel 5 ft. in diameter, under a 200 ft. head, from El Dorado Water and Deep Gravel Mining Company's ditch. Outside of the mill are 100 ft. of sluices supplied with slat riffles, in three tiers, with 12 ft. drop between them. The apron grooves are cleaned up once a month. Texas Hill Drift Mining Company, lessees; T. Flemming, of Placerville, Superintendent.

*Toll House Mining Company's Mine (Drift).*—Its property comprises the Hook and Ladder, Henry Clay, and Cowan claims. See our Xth Report, p. 179.

*Treat Mine (Quartz).*—See our VIIIth Report, p. 178.

*Trench Mine (Quartz).*—It is in T. 18 N., R. 11 E., in Quartz Cañon, S. of Volcanoville. It forms the southern extension of the Josephine Mine, and is 2,400 by 600 ft. The vein has a northerly course. The surface has been worked quite extensively, but not recently. Heirs of J. Trench, of New York, owners.

*True Consolidated Gold Mine (Quartz).*—See our VIIIth Report, p. 180. It is situated in Big Cañon, three quarters of a mile N. of Placerville; it comprises 5,400 by 600 ft., consisting of the Halleck, Berry, Old Harmon, and Young Harmon claims. There are two parallel veins having a N.W. trend. The one running between a greenstone hanging-and a slate foot-wall has a width of 4 ft. The other, running through the Old and the Young Harmon, is much larger, averaging 15 ft., and reaching up to 70 ft. in width; it is in black slate, which in places forms excellent roofing slate. True Consolidated Mining Company, owners; John Melton, of Placerville, Superintendent.

*Unity Mining Company's Mine (Drift).*—Its property is situated in Secs. 3 and 4, T. 10 N., R. 11 E., on Wisconsin Flat, 3 miles N.E. of Placerville, and comprises 178 acres. It is working on the "blue lead" channel, which here has a course S. 60° E. It is capped by lava to a depth of 200 ft.; the lava in places, next to the gravel, showing a decided pink coloring, although there is no distinct line of demarkation between it and the gray lava. The gravel varies in thickness from a few inches to 12 ft., and is cemented, requiring a stamp mill. Where proved, the width of the channel has been found to be 300 ft., with benches of gravel on the sides. Most of the present work is being carried on at the east bench, 13 ft. above the main channel level. The bedrock is syenite. Under the present company none of the channel proper is being worked; under the former owners, 1,700 ft. of the main channel was worked. The present workings are being carried on through an incline shaft 4 by 7 ft., with an arched roof descending at an angle of 30°, furnished with T rails and steam hoist. The shaft is not timbered. The main gangway has 6 ft. posts; the gravel drifts 3 ft. posts; the breasts are timbered with full sets. The breasts are taken 30 ft. wide. The percentage of cobbles and boulders is small, not over 5 per



cent. Each man extracts daily 5 carloads of gravel, weighing 1,100 lbs. Two shifts of four men each are employed. The gold, which is scaly, is .960 fine. The gravel is crushed in a 10-stamp mill, with 375 lb. stamps, making 90 drops per minute, with  $9\frac{1}{2}$  in. drop; discharging through a No. 10 steel wire screen, with a height of discharge of 2 in., and 6 in. of water in the battery. A great deal of the gold is rusty, for which quicksilver traps and Eureka rubbers are used, with 160 ft. of sluices with riffles. The water supply is from El Dorado Water and Deep Gravel Mining Company's ditch. Unity Mining Company, owners; G. W. Kimball, of Placerville, Superintendent.

*Valdora Mine* (Quartz).—See our VIIIth Report, p. 178.

*Vandalia Mine* (Quartz).—Abandoned. See our VIIIth Report, p. 172.

*Van Hooker Mine* (Quartz).—See our VIIIth Report, p. 181.

*Vann Mine* (Quartz).—This property is situated three quarters of a mile N. of Georgetown, in T. 12 N., R. 10 E. W. D. English and B. Baldwin, of San Francisco, owners.

*Webster Claim* (Quartz).—It is in T. 13 N., R. 11 E., in Quartz Cañon, S. of Volcanoville, and is 2,000 by 600 ft. The course of the vein is N.  $15^{\circ}$  E., with dip to the E. of about  $55^{\circ}$ , showing from 3 in. to 1 ft. of quartz between the contact of serpentine and slate. There are two tunnels on the claim, in the slate, respectively 200 ft. and 300 ft. long, cutting the vein 200 ft. below the surface. From 3 to 4 in. of water issues from the tunnels, which are not timbered. D. C. Webster, of Georgetown, owner.

*Welch Gold Mine* (Quartz).—It is situated in Bell's Ravine, half a mile N.E. from Greenwood. It is 1,500 by 600 ft., with the vein striking N.  $60^{\circ}$  W. and dipping N.E.  $55^{\circ}$ . It is 6 ft. wide, between slate walls. Numerous surface cuts have been made and much of the ground sluiced profitably. An incline has been started in the vein, reaching a depth of 45 ft., but now partially filled with water. Worked by the owner. H. Welch, of Greenwood, owner.

*White Bear Mine* (Quartz).—See our VIIIth Report, p. 182. Idle.

*Wilmantic Mine* (Quartz).—It is in the diorite, W. of the "Mother Lode." Shaft said to be 400 ft. deep.

*Wilton Gravel Mine* (Drift).—Situated 8 miles E. of Georgetown, near Otter Creek. The channel courses southerly, with a width of about 600 ft., and is opened by a bedrock tunnel running up the channel 700 ft., and an upraise of 25 ft. into the gravel; from here gangways are run both E. and W., the bedrock in the former dipping rapidly. The present workings are 60 ft. below the surface. The water supply is derived through the Daggett ditch. Timber is plentiful. W. C. Green, of Georgetown, owner.

*Woodside Mine* (Quartz).—This property is situated in Georgetown. The vein runs N. and S., in slate, and has yielded a large amount of gold; the works do not extend over 200 ft. in depth. The quartz body is large; prospects over \$3 in free gold, and carries some sulphurets. Insufficient machinery to handle the water and lack of capital were the causes of suspension. C. M. Fitzgerald, of Georgetown, owner.

*Worthington Mine* (Drift).—See XIth Report, p. 206. Idle.

*W. W. Claim* (Drift).—It is on Cement Hill, 4 miles N. of Georgetown, and is a mere prospect. A tunnel in slate bedrock is being run by two men to tap a channel supposed to cross the line of the tunnel in

a S.E. course. At present the tunnel is in 400 ft. No timbering required. The claim is 1,500 by 600 ft. R. S. Wilton, of Georgetown, owner.

*Zentgraf's Gold Mine* (Quartz).—This property was described in our VIIIth Report, p. 200, and is situated close to the North Fork of the American River, on Wild Goose Flat, 8 miles S. from Newcastle, in T. 11 N., R. 11 E. The vein strikes N.W. and dips S.E. at an angle of 40°, between granite and slate walls. J. & G. Zentgraf, of Newcastle, owners.

## FRESNO COUNTY.

Not only does Fresno County possess a well-earned reputation for productive orchards and vineyards and fertile lands, but her mountains contain numerous mineral deposits. Some of these are at present lightly esteemed, as they are situated in places difficult of access, but as facilities of transportation are extended and advances are made in manufacture and art, there is no doubt but that the minerals of Fresno will prove of great value. The mining interests are situated both in the Sierra and in the Coast Range.

In the Sierra there are veins which yield gold, silver, copper, lead, and bismuth; and there is a deposit of iron ore which is said to be one of the largest and most valuable in the world. The Sierra is timbered almost from the foothills to the snow line, and nearly every cañon has a flowing stream.

In the Coast Range, on the western side of the county, there are deposits of coal, better in quality and equal in quantity to any found in the State, and there are formations which yield petroleum and gypsum.

The principal mines in that portion of the Sierra which is included within the boundaries of Fresno County are situated in the Temperance Flat, Sycamore, and Big Dry Creek mining districts; there are some also in the vicinity of Sampson's Flat. Extensive ledges of silver- and copper-bearing ores are found high up near the snow line of the Sierra. The country rock in the mining districts of the foothill region is for the most part granitic, passing into gneissoid rocks and mica slate.

*Barnes Mine* (Quartz).—It is in Sycamore District. There are two tunnels, one 300 and the other 800 ft. in length; the vein varies from 12 to 18 in. in thickness. The milling plant consists of a 3½ ft. Huntington mill and a McGlew concentrator. G. W. Barnes, of Toll House, owner.

*Big Sampson Mine* (Quartz).—It is about 1 mile W. of Sampson's Flat. In the 50 ft. shaft and old workings it is said the vein shows a width of from 3 to 14 ft. between walls. See our VIIIth Report, p. 207. It was idle in June, 1894. The milling plant consists of a Kendall rocker mill, with a capacity of 8 tons in twenty-four hours. Heirs of B. H. Sterns, deceased, of Visalia, Tulare County, owners.

*Black Jack Mine* (Quartz).—This is a southerly extension of the Big Sampson. The developments consist of a 90 ft. shaft. A. Hammersly, of Bakersfield, Kern County, owner.

*Blue Rock (Midnight Star) Mine* (Quartz).—It is in Big Creek Mining District, and is a southerly extension of the Champion. The developments consist of an open cut and several small shafts on a ledge 4 to 10 ft. wide. Mrs. M. Jensen, of Letcher, owner.

*Boyd & Slater Claim* (Placer).—It is on Mill Creek, about 5 miles N.E. of Dunlap. In June, 1894, 6 men were engaged in sluicing on this claim. Boyd & Slater, of Dunlap, owners.

*Champion Mine* (Quartz).—This claim, on patented land in Big Dry Creek Mining District, is a southerly extension of the Defiance. Developments consist of a tunnel and shaft, partly caved. F. Gross, of Letcher, owner.

*Chipmunk Mine* (Quartz).—See Fisk Mines.

*Confidence Mine* (Quartz).—This claim is in Big Dry Creek Mining District, and is a southerly extension of the Blue Rock. Developments consist of two 60 ft. shafts, a 500 ft. tunnel, and several old workings. The ledge has a width of from 1 to 4 ft., and shows some sulphurets. See our VIIIth and Xth Reports, pp. 208 and 193. E. Loyd, of Letcher, owner.

*Crystal Springs Mine* (Quartz).—It is in Big Dry Creek Mining District, and is a northwesterly extension of the Defiance. The developments consist of a 50 ft. tunnel, and the quartz shows sulphurets and free gold. Jo Vernet, of Letcher, owner.

*Defiance Mine* (Quartz).—This claim is in Big Dry Creek Mining District. Developments consist of a 260 ft. tunnel and a 40 ft. shaft. The ledge varies in width from 8 in. to 5 ft. It dips about 80° N.E. and carries some sulphurets. F. Gross, of Letcher, owner.

*Discovery Claim* (Placer).—It is on Mill Creek, about 3 miles W. of Dunlap P. O. J. L. Gregg et al., of Dunlap, owners.

*Emma (Yorton) Mine* (Quartz).—This claim, situated in Big Dry Creek Mining District, is a southerly extension of the Mt. Sterling. The developments appear to be made on an extension of the second vein, about 1 ft. wide, mentioned in the description of the Mt. Sterling. The wall rock appears to be a gneiss, in which mica predominates. Hugh Nipper et al., of Letcher, owners.

*Fisk Mines* (Quartz).—These comprise the *Luakala*, *Phantom*, *Yankee*, *Chipmunk*, and *Tamarac* claims. They are at the junction of Triple Falls Creek and the Middle Fork of Kings River, and are about 4 miles N.E. of the Big Meadows on the Middle Fork of Kings River. The principal developments are on the *Luakala Mine*, where there is a 50 ft. shaft and a 50 ft. tunnel. The ledge is said to be 21 ft. in thickness, with a pay streak of about 2 ft., and carries sulphides of iron and silver. On the *Chipmunk* and the *Tamarac*, the ledge is said to be 30 ft. wide, with a pay streak of about 4 ft.

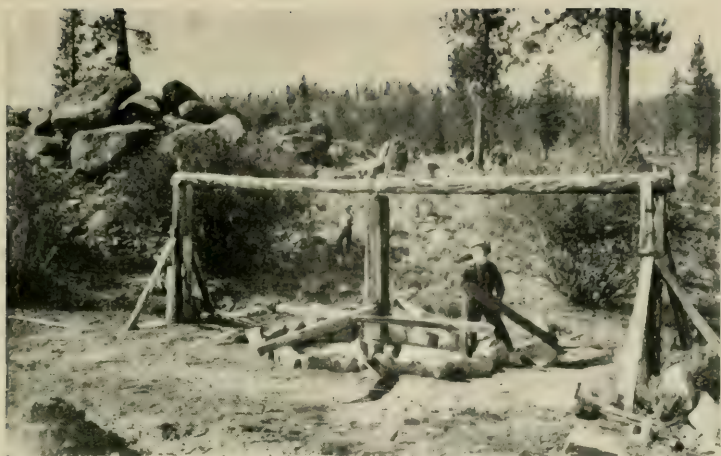
*Gilkie Mine* (Placer).—It is situated at Sampson's Flat. S. C. Moore, of Dunlap, owner.

*Grub Stake Mine* (Quartz).—This claim, in Big Dry Creek Mining District, is a northwestern extension of the Mt. Sterling. The vein is 4 to 15 in. wide. Hugh Nipper et al., of Letcher, owners.

*Hercules Mine* (Quartz).—This is situated at Sampson's Flat. The claim is opened by a 150 ft. tunnel, and the vein shows a width of from 6 in. to 3 ft. S. C. Moore, of Dunlap, owner.

*Herron Mine* (Quartz).—This mine is in Auberry Valley. The principal developments consist of an 800 ft. tunnel, with several stopes and one 30 ft. winze. There are also several old workings. The ledge varies in thickness from a few inches to 6 ft., its average width being about 3 ft., and the pay streak varies from a few inches to about 2 ft. The vein matter consists of clayey material and clean quartz showing sulphurets. The ledge dips 45° to 60° N.W. in granite. Adjoining the mine is a 5 ft. Huntington mill and two concentrators. See also our XIth Report, p. 215. Shepperd Bros. and J. C. Hosie, of Fresno, owners.





Horse-Power Arrastra, Kern County.



Water-Power Arrastra, Kern County.



Steam-Power Arrastra, Kern County.



*Hancock Mine* (Quartz).—This is a southeasterly extension of the Slocum. It is on Big Dry Creek, a tributary of Kings River, and in Sycamore District. There are four tunnels, varying from 50 to 200 ft. A rocker mill with a capacity of 5 tons in twenty-four hours is part of the plant. B. Hancock, of Letcher, owner.

*Hidden Treasure Mine* (Quartz).—This claim is near Temperance Flat. In the small shaft the ledge is about 4 ft. wide, with a pay streak of about 1 ft. W. B. Brecken and Dr. J. Graham, of Fresno, owners.

*Homestake Mine* (Placer).—On this mine, situated on Sampson's Flat Creek, work is usually prosecuted during the winter. It is said that the stratum of auriferous gravel, about 4 ft. thick, covers an area of about 10 acres. J. N. Albin et al., of Fresno, owners.

*Inyo Mine* (Quartz).—It is situated at Temperance Flat. Developments consist of four tunnels, which are respectively 400, 150, 135, and 105 ft. in length, with several stopes and old workings. The vein varies in width from a few inches to about 4 ft., showing an average width of about 2 ft. of pay ore. The vein dips about 30° N.W. The country rock is granitic. A No. 1 Kendall mill, run by steam power, is connected with the property. J. S. Johnson and N. Sullivan, of Auberry, owners.

*John Burnett Mine* (Quartz).—This claim is on patented land, and in Sec. 20, T. 11 N., R. 23 E. There is a 30 ft. shaft; and the vein, showing free gold, varies in width from 1 to 6 in., and stands nearly vertical. J. McDonell, of Sentinel, owner.

*Keno Mine* (Quartz).—In this claim at Temperance Flat, developments consist of a 240 ft. tunnel, from which two levels have been run, about 300 and 110 ft., respectively; also a 136 ft. incline. The principal vein shows a width varying from 6 in. to several feet, and dips about 60° S.W. The ledge consists of clayey matter containing fragments of quartz. There are also two or three smaller veins in the mine. At this mine there is a 10-stamp mill. Fresno Milling and Mining Company, of Fresno, owners.

*Lemmon's Mine* (Placer).—This is on Stevenson Creek, about 3 miles E. of the San Joaquin River. D. M. Lemmon, of North Fork, Madera County, owner.

*Little Monitor Mine* (Quartz).—It is in Davis Flat. A. P. Davis and S. C. Moore, of Dunlap, owners.

*Luakala Mine* (Quartz).—See Fisk Mines.

*Lucky Joe Mine* (Quartz).—This claim, in Big Dry Creek Mining District, is a northwesterly extension of the Crystal Springs. The developments consist of open cuts, and the ledge varies from about 2 in. to 1 ft. Charles Bayard, of Letcher, owner.

*McDonald Mine* (Quartz).—This is a northwesterly extension of the Barnes, and is in Sycamore District. In the 20 ft. tunnel the vein shows a width of from 12 to 18 in. J. W. McDonald, of Fresno, owner.

*Mersaba Mine* (Placer).—See Ohio Mine.

*Midnight Star Mine* (Quartz).—See Blue Rock.

*Minnette Mine* (Quartz).—This is on Upper Big Creek, in Sycamore District. In the 50 ft. tunnel the vein is said to show a thickness of about 18 in., dips about 45° N.E., and shows sulphurets and free gold; it is worked in an arrastra driven by water power. E. Minnette, of Fresno, owner.



*Morrow Mine* (Quartz).—See Petrea.

*Mount Stirling Mine* (Quartz).—This mine is situated between Fancher and Dog Creek. Developments consist of four 30 ft. shafts and one 160 ft. shaft. The vein on which the principal workings are situated shows a width of from 6 in. to about 2 ft., and dips 80° N.E. The ore is sugar-grained quartz, showing free gold and a few sulphurets. On this claim there is a second vein, about 1 ft. wide, running nearly parallel to the other at a distance of about 150 ft. The ore has a coarser structure and is said to be of lower grade. M. V. Ashbrook, of Letcher, owner.

*Music Mine* (Quartz).—See Providence.

*Ninety-nine Mine* (Quartz).—This claim is in Sec. 10, T. 14 S., R. 26 E. It is said that the developments consist of a 175 ft. and a 75 ft. tunnel, and a 100 ft. and a 20 ft. shaft; also that the vein varies in width from 1 to 3 ft. L. W. Howell, of Dunlap, owner.

*Ohio and Mersaba Mines* (Placer).—They are situated on the San Joaquin River at the mouth of Fine Gold Gulch, and about 5 miles up the river from Pollasky. It is proposed to turn the water from a bend of the San Joaquin and work its channel. Ohio Gold Mining Company, of Fresno, owners.

*Oro Fino, Nos. 1 and 2, Mines* (Quartz).—These claims are at Davis Flat, about 2 miles N. from Sampson's Flat. There is a small shaft and short tunnel and also a large open cut, which has been formed by ground-sluicing. See our VIIIth Report, pp. 207 and 208. A. P. Davis, of Traver, owner.

*Petrea (Morrow) Mine* (Quartz).—It is on Little Dry Creek, in Sec. 7, T. 11 S., R. 23 E. A. W. Petrea, of Fresno, owner.

*Phantom Mine* (Quartz).—See Fisk Mines.

*Protection Mine* (Quartz).—In this claim at Temperance Flat, developments consist of a 50 ft. shaft and open cuts. The veins show a width of between 3 and 4 ft., and dip about 40° N.W. J. Hosie and W. A. Shepperd, of Fresno, owners.

*Providence (Music) Mine* (Quartz).—This claim is on Pine Ridge, in Sycamore Mining District. It is said that the developments consist of a 200 ft. shaft, two 500 ft. levels, and two that are about 300 ft. in length. The ore is worked in a Dodge pulverizer. See our VIIIth Report, p. 206. — Howard, of Toll House, owner.

*Quien Sabe Mine* (Quartz).—This mine is about 1½ miles N.W. of Temperance Flat. Developments consist of a small shaft and a 600 ft. tunnel. D. H. Jackson, of Auberry, owner.

*Rattlesnake Mine* (Quartz).—This claim, which is patented, is about 1 mile W. of Temperance Flat. Developments consist of several tunnels and shafts, which in May, 1894, were partly filled with water. See our VIIIth Report, p. 215. D. H. Jackson, of Oakland, Alameda County, owner.

*Sampson Mine* (Quartz).—See Big Sampson Mine.

*Sawyer & Murray Claim* (Placer).—Situated on Mill Creek, about 5 miles N.E. of Dunlap. In June, 1894, four men were sluicing. Sawyer & Murray, of Dunlap, owners.

*Slocum Mine* (Quartz).—This is a southeasterly extension of the Barnes, and is in Sycamore District. The developments consist of a 30 ft., a 50 ft., and a 100 ft. tunnel. — Slocum, of Reedley, owner.

*Smuggle Mine* (Quartz).—This mine is at Temperance Flat. Developments consist of a 25 and a 40 ft. tunnel. The vein shows a width of

about 5 in. and dips about 60° N.W. The walls are granitic; ore shows sulphurets. R. Welch and H. T. Harrison, of Auberry, owners.

*Speedy Mine* (Quartz).—This claim, at Temperance Flat, is a south-westerly extension of the Wide-Awake. Developments consist of a 10 ft. shaft and open cuts. The vein shows a width of about 2 ft. The walls are granitic. H. Rauscher, of Auberry, owner.

*Tamarac Mine* (Quartz).—See Fisk Mines.

*Temperance Mine* (Quartz).—See Wide-Awake Mine.

*Thornton Mine* (Drift).—This claim is 4 miles S.W. of Temperance Flat, on the east bank of the San Joaquin. Developments consist of more than 100 ft. of tunnels and drifts. During the winter, water for sluicing is obtained from creeks and gulches, and in summer it is pumped from the San Joaquin River. Four men are employed. See our XIth Report, p. 215. O. B. Ols et al., of Fresno, owners.

*Thorn Mine* (Quartz).—It is in Big Dry Creek Mining District. Developments consist of a 120 and a 60 ft. tunnel, with stopes. The vein is said to have a width of from 6 to 18 in. T. Waxford, of Sentinel, owner.

*Valley View Mine* (Quartz).—This claim is in Sec. 32, T. 11 S., R. 22 E. Developments consist of a 40 ft. shaft and a 140 ft. tunnel. The vein varies from a few inches to about one foot. It stands nearly vertical and has a strike of S.E. and N.W. The sugar-grained quartz shows free gold. Chris. Petersen, of Sentinel, owner.

*Victoria Mine* (Quartz).—It is at Temperance Flat. Developments consist of two 30 ft. tunnels; the vein shows an average width of about 14 in. J. R. Whittaker et al., of Auberry, owners.

*Wakefield Mine* (Placer).—This is in Dinkley Creek, a tributary of Laurel Creek, and in Sycamore Mining District. W. Wakefield, of Toll House, owner.

*Weatherby Mine* (Quartz).—It is in Auberry Valley. Developments consist of a 100 ft. incline, with stopes, and a 140 ft. incline, from which two drifts have been run upon the vein for a distance of 100 ft. and 60 ft., respectively. The width of the vein varies from 12 to 14 in., and dips 30° N.W. Logan Baird et al., of Garfield, owners.

*White Cross Mine* (Quartz).—It is in Sec. 10, T. 14 S., R. 26 E. Developments are said to consist of a 100 ft. tunnel and a 30 ft. shaft. See our VIIIth Report, p. 208. T. L. Reed et al., of Reedley, owners.

*Wide-Awake (Temperance) Mine* (Quartz).—In this mine, at Temperance Flat, developments consist of a 100 ft. tunnel, three 40 ft. stopes, and several workings. The vein varies in width from a few inches to about 2 ft., and dips about 30° N.W. The ore shows sulphurets, and the walls are granitic. W. Dolph and J. Golden, of Auberry, owners.

*Yankee Mine* (Quartz).—See Fisk Mines.

*Yorton Mine* (Quartz).—See Emma Mine.

#### GLENN COUNTY.

This county occupies a central position among the counties of the Sacramento Valley. The eastern and central portions of the county possess some of the finest wheat-growing lands in the State. Farther westward are foothills and valleys, where good crops are the rule. Orchards thrive without irrigation. There is a good range for stock at all seasons of the year.

In the mountains on the western border of the county, there are

extensive deposits of chromic iron, and "prospects" of cinnabar and gold-bearing ore are reported. There are also several valuable mineral springs.

*The Milsap Mine (Quartz).*—This mine is situated between Grindstone Creek and Milsap Creek. In August, 1894, two men were employed in prospecting the ledge, which is almost 4 ft. in width.

#### HUMBOLDT COUNTY.

*Big Bar Mine (Hydraulic).*—This claim was filled by high water in 1890 and the ditches destroyed. No attempt has since been made to reopen the mine, although there are several acres of rich gravel left.

*Big Lagoon, Gold Sand at.*—See our XIth Report, p. 230.

*Bistel Mine (Hydraulic).*—It lies along Trinity River, 1 mile below Brown Station, at the mouth of Willow Creek. About 500 in. of water is derived from Willow Creek, through 2 miles of ditch and 1,000 ft. of 12 in. pipe to a giant with  $3\frac{1}{2}$  and 4 in. nozzles. The bedrock is soft blue slate and lies 10 to 25 ft. above the river. The banks are 25 ft. high, and average 8 ft. of pay gravel. The claim is on an old channel, which runs parallel to the channel of Trinity River for nearly 2 miles, the whole of which is said to be rich in coarse gold. The claim has been idle for some time, on account of the dam and upper part of the ditch being washed out by the floods in Willow Creek.

*Croton Bar Mine (Hydraulic).*—It is on the Klamath River,  $1\frac{1}{2}$  miles above Orleans. It comprises 20 acres and has 2,000 ft. frontage on the river. The bedrock is micaceous slate and lies some 40 ft. above low water in the river. The bank is 50 ft. high and the gravel 30 ft. deep. About 500 inches of water is taken out of Wilson Creek by a ditch and flume, 18 by 14 in., 2 miles long, on a grade of  $2\frac{1}{4}$  in. per 12 ft. Half a mile of pipe is in use, 24 in., 18 in., 15 in., and 11 in. in diameter; also two giants, with  $3\frac{1}{2}$  and 4 in. nozzles, under 150 ft. pressure. The sluices, 2 by 20 in., are 400 ft. long and have a grade of 9 in. per box. The water season is about six months; and about 1 acre was cleaned up last winter. E. Markerson, of Orleans, owner.

*Ferris Claim (Placer).*—This is on the Klamath River, about 1 mile below Orleans. It contains 30 acres of ground and has 500 ft. frontage on the river. One mile of ditch collects water from a number of small gulches, and delivers about 100 in. for three months in the year. There are 600 ft. of 9 in. pipe and a giant with 4 in. nozzle under a 60 ft. head, and 200 ft. of sluices, 18 by 18 in., with block riffles. A. Ferris, of Orleans, owner.

Mr. Ferris is doing some sluicing on a bar in the Klamath River at present (September, 1894). A wooden dump car running on a wooden track is used to run the gravel to the main channel, where, by an ingenious arrangement of cheap wingdams, sufficient water is diverted to fill the sluices and keep them clear. There are 60 ft. of 12 by 12 in. sluices, and about 15 cu. yds. of material are washed per day. The gravel deposit on bedrock is about 3 ft. deep, and is said to be renewed every year by deposition of gold and gravel during high water.

*Graham Flat Mine (Hydraulic).*—See Orleans Bar.

*Hoopa Valley.*—It is the general belief that the bars along the river throughout the Reservation are very rich, but as the Indians object to having them worked, nothing is done.



*Johnson Ranch, Gold Washing at the.*—See our XIth Report, p. 332.

*Klamath River.*—The hydraulic mines along the river in Humboldt County derive their water from the tributaries, and can only be worked successfully during the rainy season and in the spring.

*Lower Gold Bluffs, Beach Washing at.*—Is still carried on in a small way. See our XIth Report, p. 232.

*Manapier Mine (Placer).*—It is half a mile below Klamath Bluff. One quarter of a mile of ditch brings about 150 in. of water from Blockser Creek, and 80 ft. of 6 in. pipe and a hose with a 2 in. nozzle are used. F. Sebastian, of Klamath Bluff, owner.

*Maston Claim (Placer).*—It lies at the mouth of the North Fork of Trinity River, and comprises about 300 acres of gravel, said to be very rich. A ditch 8 miles long and nearly completed will furnish 1,000 in. of water under a 200 ft. head. J. J. Maston, Superintendent.

*Mettah Mine (Placer).*—It is about 4 miles above Klamath Bluff. The gravel is on a low bar in the river and on the bank, and is worked in rockers. The claim is covered during flood stages of the river, and can be worked only during the summer.

*Morris' Claim (Placer).*—This is on Willow Creek, S. of the Hoopa Reservation. The gravel in the bottom of the creek is from a few inches to 8 ft. deep. Wingdams are used to divert the water and expose the bed of the creek. The gold is coarse and angular, and is often attached to pieces of quartz, which may indicate that it has not traveled for any great distance.

*Orleans Bar Placer Mining Company's Mine (Hydraulic).*—They own about 2,500 acres, partly patented, in and around the town of Orleans. They built a ditch 11 miles long, to bring the water of Camp Creek, which is quite a large stream, but in January, 1890, an unprecedentedly heavy fall of snow, followed by a warm rain, washed out a great part of it and it has not been repaired.

The upper workings were formerly known as the *Wilder Claim*, and as it is supplied by an independent ditch from Little Wilder Creek and Sim's Gulch, work is carried on there every winter. The claim contains 1,000 acres of patented land immediately above the town. The ditch is 6 miles long and furnishes 300 in. of water under a 125 ft. pressure, eight months in the year. They use 600 ft. of 18 in. and 15 in. pipe, two "giants" with 4 in. nozzles, and 900 ft. of 26 in. sluices, on a 6 in. grade, with block riffles. The gold, generally of the size of a pin head, is mostly caught with the first 150 ft. of the sluices, and this part is cleaned up every ten days. The bedrock is a soft micaceous slate, containing seams of quartz and iron sulphurets. The bank is 30 ft. high and shows about 8 ft. of pay gravel.

The lower works are about 1 mile below the town, and were formerly known as the *Graham Flat Claim*. The bar embraces 28 acres of gravel, 30 to 50 ft. deep. About 2 acres were cleaned up here before the Camp Creek ditch broke, and it is said yielded satisfactorily. The sluices are 42 in. wide and 30 in. deep. The water is delivered through 800 ft. of pipe under a 350 ft. head. The bedrock lies 30 ft. above the river, so that tailings are easily disposed of. Freight per pack train from end of railroad at Korbek to Orleans is 3 cents per pound, and it takes ten to twelve days for the round trip. Owned in London, England; Mr. P. L. Young, of Crescent City, Superintendent.

*Pearch Mine* (Hydraulic).—It is on the Klamath, 1 mile above and opposite Orleans. It contains 80 acres and has about half a mile frontage on the river. A ditch 1 mile long from Pearch or Mill Creek furnishes about 900 inches of water. There are 700 ft. of 22 in. and 15 in. pipe, delivering the water under a 125 ft. pressure to two "giants," with 4 in. and 6 in. nozzles. There are two sluices 300 and 700 ft. long, 30 in. wide, with 6 in. grade. The banks are 50 ft. high and nearly all gravel. A sawmill on the claim furnishes the lumber; the 56 in. saw is driven by a  $3\frac{1}{2}$  ft. hurdy wheel, by water taken from the main pipe under pressure of about 100 ft. J. A. Pearch, of Orleans, owner.

*Red Cap Mine* (Hydraulic).—It is on the right bank of Klamath River, opposite the mouth of Red Cap Creek. Water is derived from Little Red Cap Creek by a ditch  $1\frac{1}{4}$  miles long, using flumes 16 by 15 in. on a grade of  $1\frac{1}{2}$  in. in 12 ft.; 500 ft. of 11 and 7 in. pipe delivers the water, under a 150 ft. head, to a "giant" with 3 in. nozzle. A small reservoir is used to collect water enough to run three hours per day during the dry season. There are 600 ft. of sluices, 24 by 20 in., with block riffles and on a 7 in. grade per box. There remains about 10 acres of gravel unworked. Wm. Lord, of Orleans, owner.

*Redwood Creek, Beach Washing at the Mouth of.*—See our XIth Report, p. 232.

*Salstrom's Mine* (Placer).—This is  $1\frac{1}{2}$  miles below Orleans, on the Klamath River and Camp Creek. The claim contains 80 acres, partly on a low shelf, which is submerged during flood stages of the river, and partly on the second shelf, where the bedrock lies 30 ft. above high water. A flume 36 by 16 in., one third of a mile long, delivers 800 in. of water from Salstrom Creek through 650 ft. of 14 in. and 10 in. pipe to a "giant" with a 3 in. nozzle, under 130 ft. head. The bank varies from 25 to 50 ft. in height, and the pay gravel from 10 to 30 ft. There are 400 ft. of sluices. As stated above, the lower shelf is covered with water when the river is high, and in the summer when the bar could be worked there is no water in Salstrom Creek. It is therefore necessary to build a ditch 3 miles long to bring water from Camp Creek, which has sufficient during the summer to permit work in a small way. Jonas Salstrom, of Orleans, owner.

*Trinity River.*—All along the river prospectors are at work washing with rockers or sluices either in the bed or on the banks of the river. They are said to earn not less than a dollar per day.

*Two-Yoke Bar Mine* (Hydraulic).—This is on the Klamath River, 2 miles below Orleans. During high water in 1890 the claim was filled and the ditches destroyed. No work has been done since.

*Upper Gold Bluffs.*—They are situated on the seashore, and extend south from Osagon Creek about 5 miles. The bluffs from which the property is named rise to the height of from 200 to 300 ft., and are composed for the most part of friable sandstone and conglomerate, the latter predominating. At the base of the bluffs the dip is about  $15^{\circ}$  N.E. In the upper portions of the bluffs the conglomerate is interstratified with well-defined strata of yellowish sand and light-colored sediment, which are practically horizontal. The only fossils are a few lignitized plant remains. The conglomerate is said to be auriferous and to supply the gold which is found on the seashore at the Gold Bluffs. This conglomerate extends inland, and several years ago hydraulic mining was carried on, and 1,000 ft. of tunnel was run to divert water from Prairie

Creek. It is said that in 1879 the Upper Gold Bluffs property was surveyed so that the surface of the conglomerate or gravel was divided by survey lines which formed 180 intersections, which were equal distances apart; that prospect shafts were sunk at each intersection, and that auriferous gravel was found in every shaft. (A few panfuls of gravel from one of these shafts yielded several colors of rather coarse gold.) The present owner states that experimental washings, in several places, have shown as high as 20 cents in gold to the cubic yard. Edson Adams, of Oakland, Alameda County, owner.

*Uscellena Mine* (Hydraulic).—It is on the Klamath River, 7 miles above Orleans. The bank is 60 ft. high, and shows 15 ft. of pay gravel. A ditch 3 miles long collects 300 to 400 in. of water from Mud Creek and several smaller streams. There are 500 ft. of 14 in. and 11 in. pipe; a giant with a 3 in. nozzle, under a 160 ft. pressure; and 350 ft. of 24 in. sluices, with block riffles. The ditches of this claim were injured to some extent during the high water of 1890 and have not been restored completely, so that the mine is worked only in a small way. L. Nelson, of Orleans, owner.

*White's Claim* (Placer).—See Morris' Claim, which it adjoins.

*Weitchpec Mine* (Hydraulic).—It is at the lower end of the village of the same name, opposite the mouth of Trinity River. It contains 25 acres of gravel. Water is derived from a number of small reservoirs in Weitchpec Creek and carried through a ditch half a mile long with flumes 32 in. wide, on a grade of  $\frac{3}{4}$  in. to 12 ft. The water is delivered through 500 ft. of 11 in. pipe to a giant with 4 in. nozzle, under 125 ft. pressure. The sluices are 400 ft. long and 24 in. wide. The bedrock is a very soft talcose slate, and is about 30 ft. above the river. The bank is 30 ft. high and shows 10 ft. of gravel. Many large boulders are found and a large derrick is used to pile them to one side. The hoisting is done with a small wooden hurdy wheel, taking its water from the pipe immediately above the giant. This is the only mine on the Klamath River in Humboldt County which has water enough to run all summer. Wm. Lord, of Orleans, owner.

*Wilder Claim* (Hydraulic).—See Orleans Bar.

*Young's Mine* (Hydraulic).—This is on the Klamath River, 10 miles above Klamath Bluff. Water is obtained from a number of small creeks by short ditches. There are 250 ft. of 11 in. pipe and a small giant under 100 ft. pressure. The bedrock is about 300 ft. above the river, and consists of a soft blue slate. The claim is nearly worked out, only a small patch of gravel remaining. Mr. Young, of Weitchpec, owner.

#### INYO COUNTY.

Inyo County is not a very large producer of gold, its output of that metal being less than its silver product. There are, however, several small gold camps from which there was a total output, in 1893, of \$25,944, an increase over the previous year's record.

*Abe Lincoln Mine* (Quartz).—See Lonella Mine.

*American Flag Mine* (Quartz).—It is on the ridge between Craig's and Allen's cañons, on the eastern slope of the Inyo range. The elevation is about 7,000 ft. The ledge varies from 1 to 4 ft. in width, inclosed in granite, and is developed by a tunnel 45 ft. long. The greater portion of the vein carries a little gold, but there are in places very rich pockets



of galena associated with coarse gold. The gold is sometimes found inclosed in the galena. Victor Trapier, of Lone Pine, owner.

*Argus Cañon Gold Mines* (Quartz).—Near the mouth of Argus Cañon, on the western slope of the Argus range, are fifteen claims. The ledges are characterized by the excess of the gold contents over the silver, but in general appearance resemble the others in this part of Inyo County. They lie on both sides of Argus Cañon, the southerly ones being quite flat, while the northerly ones are steeply inclined. The greatest development is on the South Inyo claim, on the north side of the cañon. A tunnel has been run on the ledge 120 ft., showing a thickness of 1 to 4 ft. The quartz is hard but honeycombed. One half mile north, on another claim, a tunnel has been run 80 ft. South of Argus Cañon is a large vein, on which five locations have been made. W. C. Wilson, of Mojave, Kern County, owner.

*Baranca Mine* (Quartz).—This mine is situated on the ridge south of Craig's Cañon, on the eastern slope of the Inyo range; the altitude is 7,000 ft. A number of veins occur on this claim, all of which have been more or less worked. The greatest development is a 250 ft. tunnel. Adjoining this mine are two other claims, on which some work has been done.

*Bonanza Mine* (Quartz).—This mine is 25 miles S. of Darwin, in Mountain Spring Cañon. The ledge is inclosed in granite, and is quite irregular, varying from mere stringers to 2 ft. in width. A depth of 200 ft. has been reached on the incline, with drifts N. and S. Three other veins run parallel with the main one. The ore is milled in an arrastra. John Andrada, of Freeman P. O., owner.

*Briton & Porter Mine* (Quartz).—It is situated on the north side of Robles Cañon, at an altitude of 6,600 ft. Although this is one of the oldest mines in the district, it has laid idle until recently. Work is now in progress upon a large vein of sugary quartz. The old incline, which followed the vein in, is 170 ft. long, and will be extended several hundred feet, if the indications are favorable. The vein is 2 to 7 ft. wide, and strikes E. and W., and dips  $20^{\circ}$  to  $25^{\circ}$  N. into a granitic spur of the Inyo range.

Farther west on the same vein, and owned by the same parties, is the *Bronco Mine*, where a shaft has been sunk to a depth of 110 ft. The dip is  $70^{\circ}$ . The quartz carries free gold, and a little silver in galena, copper and iron sulphurets. The vein as a whole is one of the largest and most regular in the district. If the developments are favorable it is the intention to erect a 10-stamp mill at the junction of Robles and Hunter's cañons, where there is nearly 20 in. of water. The ore can be sent to the mill on a tramway. J. J. Haley, of San Francisco, owner; W. L. Hunter, of Independence, Superintendent.

*Brown Monster (Eclipse) Mine* (Quartz).—It is near the western base of the Inyo range, and S.E. of Independence. The vein lies in limestone, dips into the range at an angle of  $15^{\circ}$  to  $20^{\circ}$ , and averages 5 ft. wide. An incline for a double track has been sunk on the vein to a distance of 400 ft. Although this is essentially a gold mine, there is frequently found a thin layer of silver-bearing galena on the hanging-wall. The most of the gold is found in iron streaks running through the quartz. In the stopes to the left of the incline the vein was found to be 12 ft. thick; in the bottom of the incline it is said to be 5 ft. thick, dipping  $25^{\circ}$ . The ore was transported by a tramway to the river, where a

20-stamp mill was operated for many years. See our VIIIth Report, p. 263. A. W. Eibeshutz, of Independence, owner.

*Chilula, Gavilan, Montano, and San Antonio Mines* (Quartz).—This group is situated near the head of Robles Cañon, on the eastern part of the Inyo range.

*The Chilula* lies partly in limestone and partly in granite. The limestone is found on the western end of the claim, and it is here that silver ore is found. On the eastern end of the claim a tunnel has been run 400 ft. in granite. A rich shoot of ore was followed down from the surface to this tunnel. As the ledge passes from the granite to the limestone, the most of the gold content disappears and silver-bearing galena takes its place.

*The Gavilan* is one of the few vertical veins in the district. It lies on the south side of the cañon, which is quite precipitous at this point. The ledge was finely exposed vertically for a distance of 100 ft., and it was only necessary to blast it from the wall of the cañon. It averages 5 ft. in width, and has been worked at least 200 ft. in depth. The strike is E. and W., and the inclosing formation granite.

*The Montano* is a bunchy vein near by, which has been opened to about 50 ft. in depth. North of the cañon is another of this group of mines, where a vein has been opened by inclines and considerable stoping done. It is 5 ft. wide in places and dips N., and is quite similar to and lies a little above the Bronco Mine. Wilson & Montano, of Lone Pine, owners.

*Garfield Mine* (Quartz).—This mine is one of the oldest in the Fish Springs District. A large amount of work has been done on a small ledge, which tips W. at a small angle. The quartz is bunchy and pockety in character. This property was abandoned at one time, but has recently been relocated, and is now being worked. Jerry Moiers, of Independence, owner.

*Georgia Mine* (Quartz).—It is on the western slope of the White Mountains, 10 miles E. of Bishop Creek. In the granitic country rock are two sets of veins; the flat ones often contain gold-bearing quartz, while the other set, which are more nearly vertical, is barren. The flat ledges run N.W. and S.E. The vein on which the Georgia Mine is situated has a width varying from a mere seam up to 20 in. The ore is high grade, the gold being mostly free. There is a small amount of iron and copper sulphurets. This mine is developed by 260 ft. of tunnels and 75 ft. of winzes.

*Gold Bug Mine* (Quartz).—It is on Fish Springs Hill, 20 miles N. of Independence. The vein is small, and runs E. and W. on the contact of granite with a dark, fine-grained dike. A large amount of work has been done on this mine. There are three tunnels; the upper is 115, the middle 600, and the lower 200 ft. long. The sulphurets are abundant and rich, and the gold fine.

*Gold Gulch Mine* (Quartz).—This is a recent discovery, situated in Gold Gulch, on the western slope of the Panamint range. Here four claims have been located on a vein running N.E. and S.W., and dipping 45°; the hanging-wall being limestone. The vein is said to be 18 in. wide and traceable for a thousand feet. Messrs. R. W. McIntyre, M. F. Clute, Geo. Calwell, and O. W. Shafer, of Redlands, owners.

*Golden Reef Mine* (Quartz).—It is in the Fish Springs District, 18 miles N. of Independence. The vein is inclosed in a granitic rock, and

strikes nearly N. and S. and dips about  $45^{\circ}$  E. It varies in width from a mere stringer to 20 in., and consists of iron and copper sulphurets, brown iron, and free gold. The free gold is obtained by crushing in an arrastra, and the tailings, which are rich, are saved for future treatment. J. McSorty, of Big Pine, owner.

*Hirsh Mine* (Quartz).—It is situated on the western slope of the Inyo range and a little above the Brown Monster. It is developed by a tunnel 100 ft. long and a drift south on the ledge 200 ft. From the drift three winzes were sunk. The vein is 4 to 8 ft. wide, and consists partly of gold-bearing quartz and partly of galena carrying silver. The galena occurs on the foot-wall, and at one spot was found to be 3 ft. in width. The ledge strikes N. and S. and dips  $30^{\circ}$  E. The most of the work in this mine has been done during the last three years, although it was opened many years ago. Nathan Rhine, of Independence, owner.

*Hope Mine* (Quartz).—It is situated near the base of the Inyo range, 15 miles N. of Independence. Considerable work was done here years ago. The vein, though somewhat bunchy, can be traced for nearly a mile. A number of shafts have been sunk upon it, the deepest being about 100 ft. The vein extends N. and S. in granite, and dips nearly vertical. The richer portions of the quartz near the surface are honey-combed, but below it undoubtedly will contain a large amount of iron sulphurets. Nathan Rhine, of Independence, owner.

*Josephine Mine* (Quartz).—It is about 8 miles S.W. of Darwin and 1 mile from the Mariposa. A great amount of work has been done here, as shown by the numerous long tunnels, shafts, and surface cuts. The vein runs S.E. and N.W., but is quite irregular in dip. The ore carries more copper sulphurets than the Mariposa, but otherwise is very similar. Most of the ore taken from these mines was worked by Mexicans in arrastras years ago. At Coso, half a mile away, there is a 5-stamp mill. J. Wilson, of Lone Pine, owner.

*Keys Mine* (Quartz).—It is situated on an eastern spur of the Inyo range, 20 miles E. of Independence. The vein occurs in granite, striking E. and W. and dipping N. It is 12 to 20 in. wide. The ore is worked in an arrastra in a cañon to the south. The developments here consist of two inclines, from which drifts have been run on the vein. P. Keys, of Independence, owner.

*Keynote Mining Group* (Quartz).—They are the *Beauty*, *Queen*, *Lone Pine*, *Mexican*, *King*, and *El Paso*, and are situated on the sides of Keynote Cañon, on the eastern slope of the Inyo range. The elevation is about 8,000 ft. The mine with the greatest development is the Keynote. The vein runs N. and S. and dips  $40^{\circ}$  W. It varies from a mere stringer up to 4 ft. in thickness, and carries free gold, a little galena containing silver, and copper and iron sulphurets. This is the deepest mine in the district, being opened 700 ft. on the incline. There are four tunnels, the longest of which is 700 ft.; the longest upraise is 290 ft. In the lowest tunnel a good body of ore was being worked in 1894; the ore was packed 3 miles to the Laskey mill in Hans Cañon. It was opened in 1880. The ore from these claims is similar. J. Laskey, of 1706 Geary Street, San Francisco, owner.

*Laura and McAvoy Mines* (Quartz).—The Laura Mine lies on the ridge S. of McAvoy Cañon, on the eastern slope of the Inyo range. The vein is a bunchy quartz, apparently pockety in character, and has not been worked for years. North of the cañon are a number of old mines



which have not been worked for several years, and these deposits have also the appearance of being pockety. In the cañon below the mines is a 5-stamp mill.

*Luella (Abe Lincoln) Mine* (Quartz).—This mine is situated in the Alabama District, 5 miles N. of Lone Pine. A large amount of work was done here in years gone by, but it was finally abandoned, and it is only recently that it has been relocated. The vein is very small, seldom 6 in. in width, and is inclosed in a fine-grained granite. Most of the ore is free milling. The other small veins in this district have much the same character. See our Xth Report, p. 215. John Basto, of Independence, owner.

*Magnet Mine* (Quartz).—This mine is situated on Fish Springs Hill, 20 miles N. of Independence. The country rock is granite. The vein runs E. and W. with a nearly vertical dip, and is generally small, sometimes, however, reaching a width of 2 ft. The property is developed by two tunnels, one 110 and the other 500 ft. The quartz carries free gold, and copper and iron sulphurets. It is milled in an arrastra situated about a mile distant.

*Mariposa Mine* (Quartz).—This is a patented mine in the Coso Mountains, a little N. of the town of Coso. The quartz ledge does not outcrop prominently, but has been worked for nearly 1,000 ft. through five incline shafts, the deepest of which is said to be 250 ft. In the bottom the vein is said to be 4 ft. thick. It strikes very regularly N.W. and S.E. and dips 45° N.E. J. B. Haggin, of New York, owner.

*Mazourka Cañon Placer Claims*.—They are 7 miles E. of Independence. During the latter part of July, 1894, a small cloud-burst caused to be revealed an abundance of coarse "colors" on a road in the cañon used for years in hauling wood. The gravel is from 6 to 24 in. deep. The gold is coarse, from 10 cents to \$10 nuggets; fineness, .876. There were from 70 to 80 men there September 1st, reported to be making from \$1 50 to \$30 per day. Dry washers are used.

*Polita Mine* (Quartz).—It is situated on the western slope of the White Mountains, 10 miles E. of Bishop Creek. The mine is at present being worked under a lease. The extensive developments shown here were made under the management of a company, and are a tunnel 400 ft. long, an incline of 250 ft. raised to the surface, and a winze sunk on the ledge 150 ft. The work recently done consists of the sinking of an incline on the ledge, which is well defined and 20 in. thick in the bottom. The vein strikes E. and W. and dips 35° N. The inclosing rock is limestone. The ore is decomposed and free milling, the quartz being honeycombed and often almost replaced by limonite. An arrastra has been recently erected in Redding Cañon, 1 mile S., to work the ore. George Storey, of Bishop Creek, owner.

*Post Office Springs Mines* (Quartz).—Two miles E. of Post Office Springs, and at an altitude of nearly 5,000 ft. on the Panamint range, are situated three claims on a series of gold-bearing quartz veins. These veins lie in limestone and have a N. and S. course and a dip of 40° to 60° W. The limestone terminates in bold cliffs, 300 to 400 ft. high, facing the N., and exposing the veins. The latter vary from mere stringers to 3 ft. in width. The whole hill in which the veins lie has been affected by the mineralizing agents and filled with minute interlacing quartz veins. Five veins have been opened by short tunnels and surface work. The ore is generally high grade. The quartz is honeycombed

on the surface, but below undoubtedly much of the gold is contained in iron sulphurets. The most important veins are found on the northern claim, which is known as the *Mineral Ranch*. The limestone in which the veins lie is folded in a sharp synclinal, and does not extend to the bottom of the cañon.

*Queen Mine (Quartz).*—This mine is situated on the eastern slope of Fish Springs Hill, 20 miles N. of Independence. It is developed by a tunnel 225 ft. long. The vein runs E. and W. and dips  $25^{\circ}$  to  $30^{\circ}$  N., and is from 2 in. to 2 ft. wide. Antonio Couha, of Big Pine, owner.

*Rio Vista Mine (Quartz).*—It is in the Fish Springs District and just below the *Golden Reef*. The gold has been found in a mineralized body of granitic rock, poor in mica, and termed by the miners "porphyry." This rock has been crushed, and on the surface appears reddened and honeycombed from the decay of the iron sulphurets. The deposit is apparently of considerable extent, but low grade. It has been opened by a shaft 68 ft. deep and by short tunnels. J. McArthy, of Big Pine, owner.

*Sanger Mining Company (Quartz).*—The mines of this recently organized company lie on the western slope of the Argus range, 30 miles S. of Darwin. The company controls 23 claims in a diameter of 8 miles. The formation is mostly granite. The ledges are scattered in groups, but are much alike in regard to the character of the ore and in the proportion of the gold and silver. In several claims the value of the silver is said to be greater than the value of the gold. The quartz carries iron and copper sulphurets, gray-copper ore, and occasionally a little galena. Most of the veins are found in the vicinity of Stiles Cañon, where it is the intention to erect a 5-stamp mill. Four tunnels have been run on as many different claims. Mills & Stiles, of Freeman, owners.

*Snow's Cañon Gold Mines (Quartz).*—They are the Last Chance, St. Paul, and others, and are situated on the eastern slope of the Argus range, 20 miles S.E. of Darwin. They are found on the north side of the cañon, at an average elevation of 5,000 ft. There are many locations here on a series of veins which run N.W. and S.E. The formation is generally granite, which has been forced through the limestone that forms so much of the range to the north. The veins, though small, are generally quite regular and well defined. They vary in size from mere stringers up to 4 ft. The ores are quite similar in character, except toward the east, in the direction of the contact with the limestone, where there is a considerable proportion of silver. On the surface the gold is mostly free, but toward the water-line sulphurets of iron and copper partly replace it. In many places the ore is said to be very high grade. About ten years ago a 5-stamp mill was erected here.

The *St. Paul* and *Last Chance* are the most developed, and are opened by tunnels and shafts, the greatest depth reached being 100 ft. Galena is present at times, and all the veins carry a little silver. A company has recently been organized to work a number of these claims.

*Tip Top Mine (Quartz).*—It is situated on the summit of Fish Springs Hill. The vein is supposed to be a continuation of that of the Gold Bug, and has much the same character. Upton Tracy, of Big Pine, owner.

*Wooley Mine (Quartz).*—It is situated on the southern side of Redding Cañon, 10 miles E. of Bishop Creek. There are several narrow stringers of quartz inclosed in granite, and on which a considerable amount of

work has been done. The veins are generally quite flat. — Wooley, of Bishop Creek, owner.

*Yellow Jacket Mining Company (Quartz).*—The property of this company is situated 12 miles E. of Bishop Creek, in the White Mountain range. Four claims are located here on a vein running N. and S. and inclosed in slate. The claim on which the work is being done was located years ago and finally abandoned. The old workings consist of an incline 63 ft. deep. Two tunnels have been begun by the present owners. The vein, where it has been opened, ranges from 2 in. to 2 ft. in thickness. The ore is high grade and contains a large amount of sulphurets.

#### KERN COUNTY.

In Kern County there has been a resumption of mining in several localities, the hard times having directed attention to such opportunities for the employment of labor and capital as the mining regions afford. In more than one place extensive bodies of low-grade ore can be traced for several miles, and there are many smaller propositions which seem to offer a livelihood to industrious men. The Kern River flows through one of the principal gold-bearing regions, and presents an unfailing source of water power; it must also be borne in mind that the same stream might be utilized to supply even distant works with electro-motive force. There is also an abundant supply of timber throughout a great portion of the mining regions.

The most important mineralogical event during the last two years in Kern County is the discovery of veins of comparatively *pure asphaltum* in the foothills of the Coast Range. A description of these deposits will be found elsewhere in this report.

This county possesses a large area of mineral land and a wide extent of valley land, which, by a very complete system of irrigation, is fast becoming one of the most fertile portions of California.

*Agua Caliente Mining District.*—This local name is used to designate the territory lying between the most southerly summits of the Pah Ute range and Caliente Creek, and derives its name from the hot springs situated on the Shipsey ranch. The prevalent formation is syenite, which is frequently porphyritic, and in some localities slate occurs. The characteristic geological feature of the district is the numerous trachytic dikes which traverse it. There are many mineral-bearing veins, some of which are worked. The altitude ranges from 2,500 ft. on Caliente Creek to nearly 7,000 ft. in the Pah Ute Mountains. Caliente Creek affords but very little water in the dry season.

*Amelia Mine (Quartz).*—In the Agua Caliente District. The developments are a tunnel about 60 ft. in length, and a winze about 20 ft. deep. The vein strikes N. 66° W., and dips N. 80°. An open cut, 150 ft. above the tunnel, exposes a vein over 4 ft. in thickness. C. Mohr, of Caliente, owner.

*Bald Eagle Mine (Quartz).*—It is about 5 miles N.E. of Havilah.

*Ballard Mine (Quartz).*—This is 5 miles S.W. of Glenville, in the White River Mining District. Burton & Sewell, of Glenville, owners.

*Ballard Mine (Quartz).*—It is in the White River Mining District. The developments consist of a 100 ft. shaft, a 200 ft. drift, and stopes. The vein is about 2 ft. in thickness, and dips 25° N. The quartz shows sulphurets and free gold. D. B. James, of San Francisco, owner.



*Banner Mine* (Placer).—This is in Grizzly Gulch, in White River Mining District.

*Beauregard Mine* (Quartz).—It is on the west branch of the Big Blue vein. See our VIIIth Report, p. 22.

*Beaver Mine* (Placer).—It is in Grizzly Gulch, in White River Mining District. Wolf & Eby, of White River, Tulare County, owners.

*Bella Rufin (Berry) Mine* (Quartz).—In 1893 work was resumed and a new shaft commenced. The vein has a strike of N. 65° W., dipping about 40° S.W. J. B. O'Connor et al., of Visalia, Tulare County, owners.

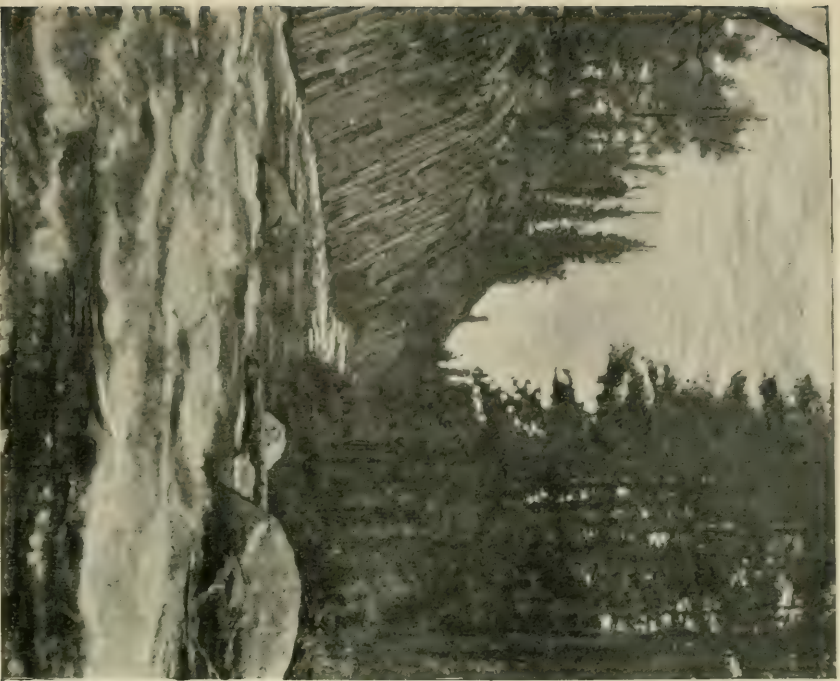
*Berry Mine* (Quartz).—See Bella Rufin.

*Big Blue (Sumner) Mine* (Quartz).—It is on the west bank of Kern River, about 1 mile N. of Kernville. It is a fissure vein, which extends through granitic and slate formations and has a general course of N. 20° E., and dips westerly, and it can be traced 4 miles, or from the southerly extension of the Nellie Dent to the northern limits of the Commonwealth. The apparent outcrop varies from 50 to 150 ft., and it is said that shoots over 50 ft. in width have been struck underground. Two tunnels have been run to strike the vein. The longer commences on the west bank of Kern River, about 250 ft. below the outcrop, and is about 2,000 ft. in length, principally in granitic rock, with a little slate just before reaching the vein. A few feet below the vein there is a clayey gouge about 4 ft. in thickness, and then 8 ft. of barren silicious rock, which constitutes what is regarded as the foot-wall of the main lead, which at this point is about 120 ft. in width. The hanging-wall appears to be altered slate. It is reported that this mine has produced a large amount of gold, and an examination of the property leads to the conclusion that there must be vast quantities of pay ore in the Big Blue which are yet untouched. The only work which has been done on this property for many years is a little tribute working. See our VIIIth Report, p. 315. Prof. T. Price, of San Francisco, owner.

*Bob Lee Mine* (Quartz).—It is about 2 miles W. of Kernville, and is on a fissure vein, dipping 35° N.E., in granite. The workings consist of three incline shafts, 140, 40, and 100 ft. deep, respectively, from which drifts have been run on the vein. The vein varies in width from a few inches to 2 ft.; its character is earthy, with decomposed clayey matter, interspersed with masses of hard quartz, which sometimes form a large portion of the vein. Nearly all the gold is free. In 1892 a 3½ ft. Huntington mill was erected on a creek about half a mile distant from the mine.

*Bright Star Mine* (Quartz).—This mine and its extensions are near the summit of Pah Ute Mountain. It is a fissure vein, which strikes S. 30° W.; the general trend of the vein through the different extensions is about S. 55° W. This variation in the strike appears to be caused by a series of southerly displacements, which probably occasioned the "pinching out" in the old workings. The country rock is metaphoric slate, which has a general northerly strike. The last attempt to reopen this mine was made in 1892 by a company organized in St. Louis, Mo., but they appear to have spent their funds without developing anything. Parke & Lacey, of San Francisco, owners.

*Brogan Mine* (Quartz).—It is in the Agua Caliente District, at an altitude of about 2,800 ft. The workings consist of an open cut 15 ft. deep and a shaft 42 ft., from the bottom of which a level has been run



Basaltic Columns on Kern River, Kern County.



Columnar Basalt near head of Kern River, Kern County.





on the lead about 60 ft. W. In September, 1893, this level was full of water. Shipsey Bros., of Caliente, owners.

*Buckhorn Mine* (Quartz).—It is in White River Mining District. An 80 ft. shaft on the vein shows 10 in. to 1½ ft. quartz in mica slate walls. W. R. Morris, of White River, Tulare County, owner.

*Bullion Mine* (Quartz).—It is about 1 mile W. of Claraville. The vein varies from a few inches to 1½ ft. in width, and strikes N. 35° E., in granite. Albert Bartholone, of Onyx, owner.

*Bull Run Mine* (Quartz).—It is on the west branch of the Big Blue vein. See our VIIIth Report, p. 321.

*Canfield Company's Mines* (Placer).—This is a recently organized company, located in Bonanza Gulch, 2 miles E. of Red Rock. Fifty-one claims have been bought up, and it is the intention to work them systematically by means of water which will be pumped either from Cohen's Springs or from Red Rock. Canfield Company, of Los Angeles, owners.

*Clay Bank Mine* (Quartz).—It is a patented claim at Havilah.

*Commonwealth Mine* (Quartz).—It is a northerly extension of the Big Blue.

*Content Mine* (Quartz).—It is a southerly extension of the Big Blue.

*Dolly Mine* (Quartz).—It is a short distance N. of Caliente Creek, and contains three different veins. One of them strikes S. 6° W., and has been prospected by two short tunnels. Another strikes S. 14° W., and the workings consist of an upper and a lower tunnel. The third vein strikes S. 70° W., and has been prospected by a tunnel which is situated at a somewhat higher elevation than the tunnels previously mentioned. Both the hanging- and foot-walls are formed of decomposed porphyritic rock, which near the ore bodies is impregnated by silicious infiltration. A. Souser, of Caliente, owner.

*Dreadnaught Mine* (Quartz).—This is a western extension of the Grizzly. The developments consist of a 190 ft. tunnel, a 60 ft. and a 35 ft. shaft, partly full of water. The vein varies in thickness from 6 in. to 3 ft., the dip being 45° S. Sulphurets and free gold visible in the quartz. N. Williams et al., of White River, Tulare County, owners.

*Eclipse No. 1 Mine* (Quartz).—Is in White River Mining District. Developed by a 75 and a 250 ft. shaft. The vein is 2 in. to 2½ ft. wide.

*Eclipse No. 3 Mine* (Quartz).—It is in the White River Mining District. The vein is 6 to 10 in. in thickness. H. M. Stanley et al., of White River, Tulare County, owners.

*Emerald Mine* (Quartz).—It is about 10 miles S. of Pah Ute Peak, and is situated in the Agua Caliente District, at an altitude of about 4,700 ft. Developments consist of a tunnel 200 ft. in length connected with a 60 ft. air shaft. The ore has been stoped 15 ft. beneath the tunnel, but deeper working was impeded by water. The strike is N. 8° W. and dip nearly vertical. Shipsey Bros., of Caliente, owners.

*Eureka Mine* (Quartz).—This mine is about 5 miles S.W. of Kernville, and in the Cove Mining District. The shaft was about 117 ft. in depth. The owner states that the vein, which was first about 3 in. in width, dipping 45° N.E., widened to 12 in. and became nearly vertical at the depth of 100 ft.

*Fairmount Mine* (Quartz).—See our XIth Report, p. 238.

*Frank Mine* (Quartz).—On the west branch of the Big Blue vein.

*Gold Dollar Mine (Quartz).*—It is near the summit of Pah Ute Mountain. The workings consist of two shafts about 35 ft. deep. The vein stands nearly vertical in slate walls, and is from 10 to 12 in. wide. Barney Collins et al., of Weldon, owners.

*Goler Consolidated Placer and Hydraulic Mining Company's Mines (Placer).*—This company has bonded a large number of claims in the vicinity of the main Goler camp. Here, as in the other camps in this district, there are large areas of gravel for which water is necessary in order to make their working profitable. It is expected that water will be brought from Owens River. (See Preliminary Geological Report on Alpine, Inyo, and Mono Counties.) Goler Consolidated Placer and Hydraulic Mining Company, of Los Angeles, owners.

*Grizzly Mine (Quartz).*—Is in Grizzly Gulch, in White River Mining District. The developments consist of a 600 ft. and a 300 ft. tunnel, a 150 ft. shaft, an open cut, and several old workings. The vein varies in thickness from 4 in. to 4 ft. It dips 45° S.W. Bates & Duffy, of San Francisco, owners.

*Hanover (Hemp Williams) Mine (Quartz).*—It is near the top of the most southerly ridge of the Pah Ute Mountains, and about 5 miles S.W. of Claraville. A tunnel about 65 ft. in length has been run on the vein, which varies from 4 to 10 in. in width; the rock is worked in an arrastra. J. Roper, of Weldon, owner.

*Haraldson and Sullivan Mines (Quartz).*—Sixteen miles N.E. of Mojave, and on the southern slope of the mountains bordering the desert, a number of claims have been recently located on a body of mineralized granite. The gold-bearing area is said to be several thousand feet in extent from N. to S., and nearly a thousand feet from E. to W. It is very low grade, but it is expected it can be made to pay. In a cañon near by it is estimated there is sufficient water for mill purposes. — Haraldson, of Tehachapi, owner.

*Harrison Mine (Quartz).*—This is in Keyesville District, on a south extension of the Mammoth. The vein courses N. 45° E., with vertical dip, between granite walls, the quartz carrying galena and iron pyrites with free gold. At a depth of 20 ft., where the influx of water retarded further sinking of the several shafts, a horse of granite divided the 3 ft. of low-grade ore on the hanging-wall from 18 in. of high-grade quartz on the foot-wall.

*Havilah District.*—Those who have worked what are locally known as the "old mines" of Havilah, are of the opinion that they are by no means exhausted. They are on a mountain side and might be drained and worked advantageously by tunneling, as the center stake of the Rochefort claim is about 1,200 ft. higher than the roadway at Havilah, the distance being 1½ miles in an air line. Kern River, about 6 miles distant, might be utilized to supply works at Havilah with electro-motive power.

*Hemp Williams Mine (Quartz).*—See Hanover.

*Henrietta Mine (Quartz).*—It is about 18 miles N. of Caliente, and it is worked intermittently. There are three shafts about 30 ft. in depth, and two tunnels, each about 100 ft. long. The quartz shows sulphurets and free gold. The vein courses nearly E. and W., and varies in width from 1 to 18 in. Both walls are granitic, and there is a clay gouge next to each wall.

*Hidden Treasure Mine* (Placer).—It is in Gordon Gulch. C. Biggs, of White River, Tulare County, owner.

*Hubbard Mine* (Quartz).—It adjoins the Emerald on the west, and has a tunnel 150 ft. in length. The vein strikes S. 64° W. and dips 30° S.E. About 50 yds. S.W. of the tunnel some work has also been done on another and parallel vein, which is about 1 ft. wide and strikes N. Shipsey Bros., of Agua Caliente, owners.

*Hugh Mann Mine* (Quartz).—See Mace.

*Iconoclast Mine* (Quartz).—It is on Erskine Creek, in Sec. 25, T. 27 S., R. 33 E. The developments consist of two tunnels, with winzes in each. The vein strikes N. 45° E., dips 80° N.W., and varies in width from a few inches to 12 ft. The quartz is more or less decomposed, and is associated with ferruginous and clayey matter. About 100 tons of ore were on the dump. The country rock is slate, which has a strike N. 55° W. Stebbins & Porter, of Havilah (Hot Springs), owners.

*Isian Camp Mine* (Placer).—It is in Grizzly Gulch, in the White River Mining District, in Sec. 10, T. 25 S., R. 29 E. A. J. Williams, of White River, Tulare County, owner.

*Jann Dosie Mine* (Quartz).—This is in the Agua Caliente District, at an altitude of 2,975 ft. There are two shafts, 100 and 110 ft. deep, and two levels, one at 30 ft. and the other at the depth of 60 ft. The vein strikes S. 82° W. and dips 60° N.W., in granite. The vein increases from 6 in. at the surface to 5 ft. in width with depth. See our XIth Report, p. 238. Stuter & McKay, of Caliente, owners.

*Jeannette Mine* (Quartz).—See Mace.

*Jeff Davis Mine* (Quartz).—It is on the west branch of the Big Blue vein. See our VIIIth Report, p. 321.

*Josephine Mine* (Quartz).—It is situated in Josephine Cañon, in White River Mining District. The developments consist of a 120 ft. incline, a 40 ft. shaft, and a 40 and a 60 ft. level. The vein varies in thickness from 1 to 8 ft., and dips 65° N.E. The walls are mica slate. The quartz shows sulphurets and free gold. F. A. Bornette, of White River, Tulare County, owner.

*Kern River Valley District*.—In the mountains forming the sides of this valley there are numerous auriferous ledges, some of which are quite extensive. The Kern River affords an unfailing source of water power. See our VIIIth Report, p. 320.

*Keyes Mine* (Quartz).—It is in the Keyesville Mining District, and 9 miles S.W. from Kernville. The main vein is very narrow at the surface, but increases to a width of 20 in. The country rock is granitic. S. Barton, of Kernville, owner.

*King Mine* (Quartz).—It is at the head of Grizzly Gulch, in the White River Mining District. On this claim there is a mass of decomposed granitic rock, permeated with ferruginous matter carrying gold. C. Newby, of White River, Tulare County, owner.

*Lady Bell Mine* (Quartz).—It is on the west branch of the Big Blue vein.

*Last Chance Mine* (Quartz).—It is a southwestern extension of the Josephine, in the White River Mining District. Developed by a 60 ft. shaft. The vein is 1 to 1½ ft. wide.

*Little Bonanza Mine* (Quartz).—This is one fourth of a mile W. of the Mammoth. The vein is 1 to 6 in. wide, carrying a few sulphurets; the walls are granitic.



*Little Jim Mine* (Quartz).—This is a westerly extension of the Occidental.

*Mace and Jeannette Claims* (Quartz).—They are 1 mile S.E. of Hanover, at an altitude of about 6,575 ft. The vein varies in width from a few inches to about 1 ft., and strikes N. 40° E.; there are several shafts of less than 100 ft. in depth yielding good ore. Hugh Mann, of Caliente, owner.

*Mamie Mine* (Quartz).—It is about 5 miles S.W. of Kernville. There is a 60 ft. shaft on the vein, which is 2 ft. wide.

*Mammoth Mine* (Quartz).—See our VIIIth Report, p. 314. This mine was reopened in 1890, and worked to December, 1892.

*Mammoth Mine* (Quartz).—This is in the White River Mining District. The developments consist of a 400 ft. and a 200 ft. tunnel, with stops. The width of the vein varies from 6 in. to 2 ft. The quartz shows sulphurets and free gold. Duke & Grover, of Santa Cruz, owners.

*Morning Star Mine* (Quartz).—This is an eastern extension of the Grizzly, in White River Mining District. The developments consist of several old shafts and tunnels. The vein shows a thickness from 6 in. to 4 ft. There is a 3½ ft. Huntington mill on this claim. Bates & Duffy, of San Francisco, owners.

*Mountain View Mine* (Quartz).—This is a western extension of the Eclipse No. 1, in the White River Mining District. The developments consist of a 20 ft. tunnel and a 20 ft. shaft. The vein, only a few inches in width, is said to be rich.

*Nellie Dent Mine* (Quartz).—See Big Blue.

*New World Mine* (Quartz).—It is in Havilah; patented. See our VIIIth Report, p. 317.

*None Such Mine* (Quartz).—This is in Grizzly Gulch, in White River Mining District. The developments consist of a 130 ft. tunnel and an open cut. The vein varies from 6 in. to 3 ft. The quartz shows sulphurets and free gold. A. R. Sorrels, of White River, Tulare County, owner.

*Occidental Mine* (Quartz).—Near Caliente Creek. There are two shafts about 30 ft. deep on the vein, which shows a thickness of 14 to 24 in., and is a decomposed quartz showing chloride of silver. Drifts have been run both E. and W. for 20 ft. The vein strikes N. 60° W. and dips 80° N. The slate walls are permeated by vein matter. The claim embraces another and smaller vein.

*Ophir (Old Bodfish) Mine* (Quartz).—It is in the Keyesville District, and 5 miles from Kernville by road. There is a 50 ft. shaft and a 25 ft. drift. The vein strikes N. 35° E. and dips N.W., and is about 5 ft. in width. Both walls are granitic. W. B. Walker et al., of Caliente, owners.

*Oriental Mine* (Quartz).—It is in Agua Caliente Creek, in the Agua Caliente Mining District. Sausser & Windheim, of Caliente, owners.

*Pin-Hook Mine* (Quartz).—This is a western extension of the Eclipse No. 1, in White River Mining District. It is said that the developments consist of a 20 ft. tunnel and a 20 ft. shaft. The vein is only a few inches in width, but is said to be rich. P. Womack, of White River, Tulare County, owner.

*Polka Dot Mine* (Quartz).—It is in Sec. 16, T. 27 S., R. 33 E., in the Valley Mining District, and about 5 miles S.E. from Hot Springs. E. Vaughn, of Havilah (Hot Springs), owner.

*Pomona Mill and Mining Company's Mines* (Placer).—The claims owned by this company are situated in the Colorado Camp, about 3 miles N. of Goler. It is the purpose of this company to erect a mill here to pulverize the gold-bearing clays and sandstones. It is expected that sufficient water can be developed from a small spring in the gulch at the camp. Pomona Milling and Mining Company, of Los Angeles, owners.

*Queen Mine* (Quartz).—It is at the head of Grizzly Gulch, in the White River Mining District. On this claim there is a mass of decomposed granitic rock, which is permeated with ferruginous matter carrying gold. F. R. Crocker, of White River, Tulare County, owner.

*Rip-Rap Mine* (Quartz).—It is about  $3\frac{1}{2}$  miles N.W. of the Emerald, at an altitude of 4,580 feet. Developments consist of a 70 ft. tunnel and a 40 ft. winze. In the winze the vein shows about 18 in. of hard quartz and 18 in. of granite mixed with quartz and clay. Both walls are granitic. The quartz breaks, on exposure, into small angular fragments, and carries about 1 per cent of sulphurets. A. J. Skinner, of Weldon, owner.

*Rocheftort Mine* (Quartz).—This is at Havilah.

*Sandstone Mine* (Quartz).—It is in the White River Mining District. A 40 ft. shaft, partly caved, and an open cut, show a mass of decomposed granitic rock, traversed by numerous ferruginous and gold-bearing veinlets. A. R. Sorrels, of White River, Tulare County, owner.

*Santa Fe Mine* (Quartz).—In White River Mining District. The vein is said to be 14 in. in thickness. H. M. Stanley et al., of White River Tulare County, owners.

*Sarah Jane Mine* (Quartz).—It adjoins the Lady Bell. Developed by a shaft 90 ft. in depth, from the bottom of which levels extend N. and S. about 200 ft. Thede & Medina, of Kernville, owners.

*Side Issue Mine* (Quartz).—It is S.E. of and adjoins the Iconoclast. Stebbins & Porter, of Havilah (Hot Springs), owners.

*Sovereign Mine* (Quartz).—It is at Havilah. A small vein has been struck in a tunnel about 80 ft. in length, which will have to be extended to cut the main vein. The croppings vary from 6 to 12 ft. in thickness. Johns and Max Helmes, of Havilah, owners.

*Sumner Mine* (Quartz).—See Big Blue.

*Surprise Mine* (Quartz).—It is an eastern extension of the Eclipse No. 1. There are two shafts, 35 and 20 ft. deep. The vein is about 3 ft. wide, and consists of a soft gouge mixed with fragments of quartz. Beaver & Crocker, of White River, Tulare County, owners.

*Sycamore Spring Mine* (Quartz).—It is in the White River Mining District. The developments consist of a 60 ft. tunnel and a 25 ft. shaft; the vein is about 8 in. wide and pitches about  $45^{\circ}$  S.W. A. W. Monroe, of White River, Tulare County, owner.

*Talc Mine* (Quartz).—This is in the White River Mining District. Developed by a 400 and a 250 ft. tunnel, with stopes. The vein varies from a few inches to  $1\frac{1}{2}$  ft. There is a  $3\frac{1}{2}$  ft. Huntington mill at this mine. G. W. King, of White River, Tulare County, owner.

*Urbana Mine* (Quartz).—It is on the west branch of the Big Blue vein.

*Veracity Mine* (Quartz).—It is 1 mile E. of Claraville. In 1893 a 40 ft. shaft was sunk and an 18 ft. drift run on the vein both E. and W. The vein strikes N.  $67^{\circ}$  E. and dips  $65^{\circ}$  E. of S., and is about 2 ft. wide, showing considerable free gold and some sulphurets. Both walls are granitic. The claim includes several other veins, from a few inches to

3 ft. in width, which traverse the granite both N. and S. of the one herein described. Barton & Patterson, of Weldon, owners.

*Warrington Mine* (Quartz).—This is at Havilah.

*White Pine Mine* (Quartz).—This mine is near Bodfish Creek, which furnishes during the winter and spring considerable water for power. It is a contact vein, the hanging-wall being crystalline limestone and the foot-wall granite, and ranges from 4 in. to 3 ft. in width, and dips 30° S.W. Burton et al., of Kernville, owners.

*Woody Mine* (Quartz).—It is in Josephine Cañon, in the White River Mining District. The developments consist of three tunnels of 100 ft. and two shafts 50 and 35 ft. The vein is about 1 ft. in thickness. J. Mayfield, of White River, Tulare County, owner.

*Yankee Bullock Mine* (Placer).—This is in Grizzly Gulch, in the White River Mining District. B. L. Tompkins, of White River, Tulare County, owner.

#### LASSEN COUNTY.

This county, from its position on the east side of the Sierra Nevada range, lies entirely outside of the California gold belt proper, and had never been considered as a mining county. Notwithstanding this fact, about twenty-five years ago, near the northern border, very rich veins and seams of gold-bearing quartz were found in altered sedimentary and eruptive formations, elevated above the surrounding lava-covered country, culminating in a hill named from one of its pioneer settlers, Hayden Hill. From this point about \$2,000,000 has been extracted from a depth not exceeding anywhere 300 ft. A similar formation may be traced northward into a locality known as Happy Camp, in Modoc County, but nowhere, so far, have paying mines been developed along its course outside of Hayden Hill. Claims have been made that some of the veins in this locality carry platinum, and from the conditions presented it is not likely that a close search might show the presence of gems that have aluminum oxide as their principal constituent. Large masses of a good quality of kaolin are found near the mines, but the distance from railroad communication makes them valueless for the present.

*Blue Bell Gold Mine* (Quartz).—It is on the W. side of Hayden Hill, adjacent to the village, and comprises 1,500 by 600 ft. The main vein courses E. and W., dips N. about 60°, and is intersected by several cross-veins. The formation is considerably broken up, consisting of altered sandstones and slates. Developments consist of several shafts sunk to a depth of 80 ft.; also open cuts. At present only assessment work is being done. The ore is free milling, and extremely rich in places. E. B. Preston et al., of Hayden Hill, owners.

*Brush Hill Mine* (Quartz).—This is E. of the village on Hayden Hill, and comprises 1,300 by 600 ft. The main vein, about 4 ft. wide, courses a little S. of W., dips about 55° N., and has conglomerate walls. A second vein runs through the ground N. and S. from the south side of the main vein, with an average width of 2 ft. The property is being worked at two points, through a shaft 45 ft. deep and an east drift 15 ft. long, where the N. and S. vein has been cut, while near the center of the claim a shaft is being sunk 250 ft. to cut the Brush Hill vein proper; this latter shaft (4 by 4½ ft.) is at present down 145 ft. The company own a 10-stamp mill on Willow Creek, 3 miles from the mine, run by an



8 ft. hurdy wheel. The stamps weigh 650 lbs. and drop 68 times per minute, with a 7 in. drop and discharge. The mortar has front and back inside plates, and they use No. 12 slot screens. The duty is three fourths of a ton to the stamp daily. The apron is 6 ft. long, set on a  $1\frac{3}{4}$  in. grade; no concentrators. See our XIth Report, p. 241. F. Vander Elst, of Hayden Hill, owner.

*Diamond Mountain Mine* (Quartz).—It is 7 miles S. of Susanville, and comprises 1,500 by 600 ft. on the east slope of Diamond Mountain, the vein coursing N.E. and S.W., dipping  $45^{\circ}$  E., in granite, with a width of 12 in. The quartz is crushed in a custom mill. Developments consist of a shaft on the vein 60 ft. deep.

*Don't Care Mine* (Quartz).—See Uncle Billy Mine.

*Evening Star Gold Mine* (Quartz).—It is on Hayden Hill, and is 1,420 by 600 ft. The property comprises several veins: the *Evening Star*, the extension of the *Golden Eagle*, and a vein running parallel with the latter. The *Evening Star* courses N.  $10^{\circ}$  W., with a nearly vertical dip, and an average width of 3 ft. The forks of the *Golden Eagle* extension have a course of N.  $75^{\circ}$  W. and N.  $65^{\circ}$  W., respectively, dipping about  $50^{\circ}$ , and a width, before forking, of 8 ft. The vein parallel to the *Golden Eagle* extension has a N.W. course, a vertical dip, and is about  $1\frac{1}{2}$  ft. wide. The wall rocks are a brecciated felsite. The two latter veins have been traced to their contact with the *Evening Star* on the east side. The developments consist of a shaft on the *Golden Eagle* extension, sunk to a depth of 120 ft., with drifts extending west from the 80 and 120 ft. levels for a distance of 150 ft., the ground being stoped to the surface; a main hoisting shaft on the *Evening Star*, 246 ft. deep, with drifts on the 90 and 120 ft. levels. This shaft is tapped near the bottom by a drain tunnel nearly 1,000 ft. in length. The ground from the 90 ft. level to the south has been stoped to the surface. Several other shafts and cuts have been opened to varying depths along the line of this vein. The ore is free milling; the gold is worth \$13 per ounce. Three miles from the mine, on Willow Creek, is a 5-stamp mill, run by a 30 ft. overshot waterwheel; the stamps weigh 650 lbs., and are run at a speed of 85 drops per minute, with 7 in. drop and discharge, using a No. 12 slot screen. The apron is 8 ft. in length, set to a grade of  $1\frac{3}{4}$  in. to the foot. The mine is under lease at present. W. Howard et al., of Hayden Hill, owners.

*Gold Belt Mine* (Quartz).—See our Xth Report, p. 274. It is  $7\frac{1}{2}$  miles S.W. from Susanville, and comprises 1,500 by 600 ft. along a vein coursing N.E. and S.W., with a vertical dip, in granite, averaging from 1 to 3 ft. in width. The quartz is low grade, with a small percentage of sulphurets. Developments consist of a tunnel 180 ft. in length, on the vein. A 5-stamp mill, run by a 5 ft. hurdy wheel, crushes the ore and does custom work. The water power is taken from Gold Run Creek and delivered under 80 ft. pressure. The mill is run at a speed of 95 drops per minute, with 5 in. drop and 4 in. discharge, using a No. 20 steel wire screen. This gives a duty of  $1\frac{1}{2}$  tons in twenty-four hours per stamp. The apron is 38 by 28 in., set on a grade  $1\frac{1}{4}$  in. to the foot, and below it a small iron pan with stirrers is used for a settler.

*Golden Eagle Mine* (Quartz).—This is on Hayden Hill E. of the village, and comprises 1,225 by 600 ft. The 4 ft. vein courses a little N. of W., dipping  $65^{\circ}$  N., in brecciated rock. The vein matter consists of crushed quartz and clay. Between the foot- and hanging-wall is a horse

of quartzite. The ore on the hanging side is of dark color, due to a large percentage of black oxide of manganese; the ore on the foot-wall is of a grayish color, being largely mixed with clay. The vein enlarges so that in places there are bodies of ore 12 ft. wide. The present workings are at the west end of the claim, and consist of a double-compartment shaft 4 by 7 ft. in the clear, 304 ft. deep, supplied with a horse-whim, with main drifts at the 150 and 220 ft. levels, and several intermediate ones. The 150 ft. level runs W. over 175 ft., and the 220 ft. level extends W. 75 ft., a small stope connecting them. Below the 220 ft. drift a winze has been sunk 50 ft. in solid pay of high grade. On Willow Creek,  $2\frac{1}{2}$  miles from the mine, the company own a 5-stamp mill, run by water, and have also leased two others, a 5-stamp and a 10-stamp mill, situated on the same creek. These mills are run by overshot and hurdy wheels, under pressures varying from 26 to 58 ft., with a constant, unfailing water supply from Willow Creek. The company has also two 11 ft. arrastras for working the higher grades of ore. The mills carry 650 lb. stamps, working in double-discharge mortars, with the back discharge closed by a plank supplied with a large silvered plate. The motion varies in the different mills from 80 to 95 drops per minute, with 7 in. drop and discharge through No. 12 slot-cut Russian iron screens. In front of the mortar are 8 ft. aprons the width of the mortar, set on a grade of  $1\frac{3}{4}$  in. to the foot, discharging into a drop box leading to 10 ft. of 20 in. sluices paved with bark riffles. The duty of the stamps is nearly one ton to the stamp. The plates are scraped once a day, and the batteries cleaned up every two weeks. The loss of gold passing off with the muddy, clayey water is quite large, but accurate data through assays have not been obtained. Dr. Schlosser et al., of Hayden Hill, owners.

*Golden Eagle Extension (Quartz).*—See Evening Star.

*Gopher Gold Mine (Quartz).*—This is on Hayden Hill, one fourth of a mile S.E. from the village, and comprises 1,500 by 600 ft. on an E. and W. vein, dipping nearly vertical, several feet in width, between sandstone and breccia. Developments consist of a shaft sunk on the foot-wall of the vein, exposing a pay seam 8 in. wide. W. Dale et al., of Hayden Hill, owners.

*Hayden Gouge Claim (Quartz).*—See Uncle Billy Mine.

*Hayden Hill Consolidated Tunnel Company (Quartz).*—This is about half a mile E. from the village on Hayden Hill, and is a tunnel-right containing 3,000 ft., and four full mining claims. The tunnel has attained a length of 1,025 ft., timbered throughout, and is ventilated by a fire-blast. The formations passed through are sandstone and quartzite. Eight hundred feet from the mouth of the tunnel a mineralized belt 30 ft. wide was cut, carrying numerous quartz seams, having a general E. and W. course. Nearer the breast of the tunnel other small quartz seams have been cut. Hayden Hill Consolidated Company, owners; N. Bieber, of Bieber, Secretary.

*Juniper Gold Mine (Quartz).*—This is west of the town, on Hayden Hill, and comprises 1,500 by 600 ft. There are two veins on the claim, a N. and S. and an E. and W. vein, the developments being confined to the latter near the crossing with the former. The N. and S. vein has a width of about 1 ft.; the other vein varies from 2 to 40 ft. between the walls, which are brecciated on the hanging and fine-grained rhyolite on the foot. The vein matter consists of quartz stringers mixed with

bowlders of the wall rock. The developments consist of a shaft 300 ft. deep, now caved. A second shaft at the east end 126 ft. deep has been drifted E. 125 ft. and W. 80 ft. under the cave. West of the main caved shaft, a clay dike dipping east cuts off the E. and W. vein. A small shaft on the west end of the claim has been sunk 60 ft. and drifted 30 ft. toward the east. Three miles from the mine, on Willow Creek, the company own a water power and four arrastras 8 ft. in diameter. The mine is being worked under a lease at present. J. McFarling et al., of Calistoga, Napa County, owners.

*McDonnell Claim* (Quartz).—See Uncle Billy Mine.

*North Star Mine* (Quartz).—This claim, 1,430 by 400 ft., is on the northwest side of Hayden Hill. The vein,  $2\frac{1}{2}$  ft. wide, courses nearly N. and S., dips about  $45^{\circ}$  W., between brecciated walls. Developments consist of two shafts sunk on the pitch of the vein 15 and 80 ft. deep; the latter drifted from, to the north. Only assessment work is done. T. Summers, of Hayden Hill, owner.

*Uncle Billy (Don't Care) Gold Mine* (Quartz).—This is on the E. side of Hayden Hill, about one fourth of a mile from the village, and comprises 1,500 by 600 ft. There are three veins: the Hayden Gouge, with a course S.  $55^{\circ}$  W.; the McDonnell, ranging S.  $55^{\circ}$  E., and the Dike, running parallel with the Hayden Gouge, but farther up the hill. The McDonnell cuts the other two, with a nearly vertical dip, carrying about 4 to 8 in. of vein matter. The Hayden Gouge averages at places over 6 ft. and dips  $45^{\circ}$  S. The Dike vein dips to the N.  $45^{\circ}$ , with a width of about 3 in. The present developments consist of a shaft sunk 80 ft. on the foot-wall of the McDonnell, and a drift of 60 ft. to its crossing with the Dike, where it turns 70 ft. on the latter. Former workings were carried on in the Hayden Gouge and the McDonnell at the same depth through a tunnel, not open at present. The hoisting is done with windlass. S. Owens et al., of Hayden Hill, owners.

#### LOS ANGELES COUNTY.

Oils and economic minerals occupy the first place in the mineral output of this county, although both placer and quartz gold mines are being operated. The late discoveries in oil in and around the city of Los Angeles are of especial interest, proving the existence of a much larger area of oil-bearing strata than had previously been known, and holding forth large inducements for the boring of numerous wells.

The large bodies of gypsum found here have helped to build up the manufacture of plaster of Paris and kindred industries. The rock formations on Catalina Island are finding an increased use for sanitary, ornamental, and electrical purposes, besides furnishing suitable material for the breakwaters and piers that are being constructed at points along the southern coast.

Gold-bearing veins are quite numerous in this county, but at present only a few of them are being worked. The quartz is mostly low grade, and a lack of water renders mining operations expensive. The principal districts are the Cedar and the Mount Gleason.

*Cedar Mining District*.—It is 55 miles N.E. of Los Angeles, the railroad station being Acton. See our VIIIth, IXth, and XIth Reports, pp. 332, 191, and 246.



*Champion Mine* (Quartz).—It is in Mount Gleason Mining District. See Mount Gleason, and our VIIIth, IXth, and XIth Reports, pp. 332, 195, and 247. S. Black, of Acton, owner.

*Eagle Mine* (Quartz).—See Mount Gleason District, which it is in. It has a strike of  $10^{\circ}$  N. A 5-stamp mill was in operation in the spring of 1894. The water supply was too limited for more expensive operation. See our VIIIth, IXth, and XIth Reports, pp. 332, 195, and 247. E. Beckman, of Santa Barbara, owner.

*Last Chance Mine* (Quartz).—It is in Cedar Mining District, 3 miles W. of Acton. E. Brough, of Acton, owner.

*Loris Mine*.—It is on the southern slope of the Sierra Madre Mountains, 4 miles N. of Pasadena. The workings are chiefly in a ferruginous metamorphic rock, from 1 to 4 ft. wide. They are erecting reduction works at the foot of the mountain, 1,400 ft. below. Their process is secret, and all information concerning it was refused. Loris Gold Mining Company, owners; E. Kennedy, of Pasadena, President.

*Mount Gleason District*.—It is 7 miles S.E. from Acton, on the S. P. R. R., 55 miles from Los Angeles. There are several claims on the two veins in the district, the Eagle and the Padre, which unite in the Padre claim. Geologically and mineralogically all the veins of this district have a marked similarity, occurring in granite, being nearly perpendicular. In width they range from 1 to 6 ft. The quartz is shattered and contains sometimes as much as 10 per cent of auriferous iron sulphurets. The rock near the surface is oxidized and porous, and is free milling. The granite is remarkable and of unusual interest because of the large amount of labradorite feldspar it contains and the small amount of mica and hornblende.

*Newhall Placers*.—On each side of Soledad Cañon, and E. of Newhall, are extensive deposits of gravel containing gold. They also extend W. along the Santa Clara River for miles. They lie in terraces, which mark the successive flood plains of an ancient river which flowed S. from the Mojave Desert. The gold is generally fine, but occasionally coarse. The gravel is partly cemented by a small amount of carbonate of lime and clay. The upper portion of the beds, from 1 to 6 ft., is iron-stained, and in places contains gold in paying quantities. In the small gulches cutting into this surface stratum good pay is frequently found. The top stratum pays from 5 to 25 cents per cubic yard. The material composing the gravel is all foreign, and is similar to that forming the great conglomerate deposits lying between Langs and Ravenna stations of the S. P. R. R. This conglomerate may also be the source of the gold. See our VIIIth, IXth, and XIth Reports, pp. 333, 201, and 248.

*New York Mine* (Quartz).—It is in Cedar District, 3 miles W. of Acton. See our VIIIth, IXth, and XIth Reports, pp. 332, 192, and 247. Thos. O'Reilly, of Ravenna, owner.

*Padre Mine* (Quartz).—It is in Mount Gleason District, 7 miles from Acton. See Mount Gleason, and our VIIIth Report, p. 332. Judge Nickel, of Acton, owner.

*Placerita Mines* (Placer and Drift).—See our VIIIth, IXth, and XIth Reports, pp. 333, 201, and 248.

*Reberg, Geo., Mine* (Quartz).—It is in Arrastra Cañon, about 10 miles E. of Newhall. The developments consist of several short tunnels and shallow shafts. The vein, although only a few inches in width, is rich in free gold; it is worked in an arrastra.

*Red Rover Mine* (Quartz).—It is in Cedar District, 3 miles W. of Acton. It has a shaft 400 ft. deep and an incline on the vein 200 ft., and is the most productive mine in the district. Operations were resumed in September, 1894, after a suspension of two years, the incline being retimbered throughout. The geological features of the mine are peculiar. The vein occurs in a dark green, massive crystalline rock. There are two main fissures, 10 to 20 ft. apart. All the rock between these fissure planes is crushed, and most of it altered and compressed into chloritic schist. This constitutes the lode, within which the shoots of gold-bearing quartz occur. These form on or near the foot-wall side of the lode and downward and along the lode to the west approaching the hanging-wall, but cut off before reaching it by a mass of country rock, which reaches from wall to wall of the lode. There is a succession of these shoots, each 40 to 65 ft. in height, the floors being 6 to 15 ft. thick. There are two separate series of shoots. The mine is equipped with steam hoist and a 10-stamp mill. See our VIIIth, IXth, and XIth Reports, pp. 332, 191, and 246. E. B. Millar, of 141 Broadway, Los Angeles, owner.

*San Francisquito Mines* (Placer).—See our VIIIth, IXth, and XIth Reports, pp. 333, 201, and 248.

*Santa Paula Mine* (Quartz).—It is in Cedar District,  $1\frac{1}{2}$  miles W. of Acton. It is a small vein that has been worked off and on for years. G. Cruger, of Acton, owner.

*Savage Mine* (Quartz).—It is in Cedar District, 5 miles W. of Acton. The croppings consist of immense masses of ferruginous quartz, interstratified with a granular talc rock. The quartz bodies are from 10 to 50 ft. wide, the whole mass being 120 ft. or more in width. A cross-cut tunnel, 40 ft. from the surface, passes through 30 ft. of solid quartz. It is said that all the quartz is gold-bearing. There is neither fuel nor water convenient. Mr. Savage, of Monrovia, owner.

*Soledad Placers*.—See Newhall.

*Topeka Mine* (Quartz).—It is in Cedar District, 3 miles W. of Acton. See our XIth Report, p. 247. E. B. Millar, of 141 Broadway, Los Angeles, owner.

*Union Mine* (Quartz).—It is in Cedar District, 5 miles W. of Acton. F. Chase et al., of Whittier, owners.

#### MADERA COUNTY.

The northeastern part of the county, or the Grub Gulch region, is once more the field of active mining operations.

The mines in the southeastern portion of Madera County are in Hildreth, Fresno, and Potter Ridge mining districts, in Jackass Mountain, and in the Minarets. It is also reported that there are large bodies of ore near the borders of Mono County, and in the territory reserved as "The Extension of the Yosemite Park."

Most of the mines in the portion of Madera County referred to are worked intermittently and in a desultory fashion. The ore is usually treated in a horse arrastra. The ore from some of the mines yields more than \$25 a ton by this method. The sulphurets are disregarded, and probably a large portion of the precious metals which the ores contain is lost. It is possible that the "cyanide process" may be well adapted for the class of ores mined here.

*Abbey Mine* (Quartz).—It is in Sec. 36, T. 9 S., R. 21 E., and has been extensively worked, the ore being treated in a 10-stamp mill and in chlorination works. See our VIIIth and Xth Reports, pp. 202 and 194. G. W. Grayson, of San Francisco, owner.

*Achsaß D. Mine* (Placer).—It is in Fine Gold Gulch, in Sec. 25, T. 10 S., R. 21 E. C. B. Holstead, of Pollasky, Fresno County, owner.

*Albion Mine* (Quartz).—This mine is in Swede Gulch, Potter Ridge Mining District. The vein shows a width of about 12 in. in the open cut and prospect shaft. T. Keefe and J. Logan, of Coarse Gold, owners.

*Alexandra Mine* (Quartz).—This is in Potter Ridge District. The vein is 18 in. wide. G. A. Krohn, of Coarse Gold, owner.

*Alpha No. 2 Mine* (Quartz).—This is in Potter Ridge District. The vein is reported to be 3 to 10 ft. wide. Developments consist of an old 80 ft. shaft. Waterloo Gold Mining Company, of San Francisco, owners.

*Alvarita Mine* (Quartz).—It is in Hildreth District. Workings consist of a short incline and an open cut on an 18 in. vein. W. Reed, of Pollasky, and Alva E. Snow, of Fresno, owners.

*Aurora Mine* (Quartz).—It is in Potter Ridge District. F. Dirks, of Coarse Gold, owner.

*Baltimore Mine* (Quartz).—It is at Jackass Mountain, and has a 400 ft. tunnel with a 28 ft. winze and a 60 ft. air shaft. The vein is about 2 ft. wide, with a pay streak 6 to 18 in. wide. It dips 70° N.W. Smith Norris, of Fresno, owner.

*Bandarita Mine* (Quartz).—In Hildreth District. D. Pray and G. W. Dean, of North Fork, owners.

*Bass Mine* (Quartz).—It is in Potter Ridge District. The vein is 6 to 10 in. wide. D. R. McKenzie and F. Rhule, of O'Neals, owners.

*Bazinet (Morrow) Mine* (Quartz).—It is in Sec. 25, T. 9 S., R. 21 E. Workings consist of a 200 ft. and a 275 ft. tunnel. The vein varies from 1 to 2½ ft. in width, and dips at an angle of about 45° S.W. See our Xth Report, p. 195. P. Bazinet, of Hildreth, owner.

*Bellevue Mine* (Quartz).—This claim is in Sec. 18, T. 10 S., R. 21 E. The 60 ft. and 150 ft. tunnels expose a 12 in. vein, which carries some sulphurets. — Besone, of Coarse Gold, owner.

*Berry Mine* (Quartz).—This is in Hildreth Mining District. There are three shafts, 60, 70, and 140 ft. deep, nearly filled with water. The 12 in. vein strikes S.W. in granite. L. V. Loomis and J. E. Falconer, of O'Neals, lessees.

*Bessie H. Mine* (Quartz).—This is in Fine Gold Gulch, in Sec. 25, T. 10 S., R. 21 E. E. Wright, of Pollasky, Fresno County, owner.

*Blind Orphan Mine* (Quartz).—It adjoins the Stemwinder on the west, at Jackass Mountain. In the 20 ft. shaft the vein is about 14 in. wide, and dips about 60° N.W. The quartz carries sulphides of iron and lead. G. D. Hitchcock and P. Sinas, of Madera, owners.

*Boulder Mine* (Placer).—This is on Fine Gold Creek, in Sec. 26, T. 9 S., R. 21 E. J. M. Bowles, of Hildreth, owner.

*Buena Ventura Mine* (Quartz).—It is in Potter Ridge District. The vein is 16 in. wide. Thos. Strombeck et al., of Coarse Gold, owners.

*Burney Mine* (Quartz).—In Potter Ridge District. Developments consist of 180, 100, and 70 ft. shafts, with drifts from the bottom of the deepest, which are 220 and 60 ft. long. The vein is 18 in. wide. D. McClellan and C. Melvin, of Coarse Gold, owners.



*Butterfly Mine* (Quartz).—This is three fourths of a mile W. of the Savannah, in mica schist. Four tunnels 100 ft. apart have been run on the vein, which strikes N. 50° W. and dips 50° N.E. A granitic dike accompanies the vein, both vein and dike cutting the inclosing slates in dip, but conforming closely with them in strike. The vein, quartz, about 14 in. wide, is crystallized, and contains quite a large percentage of iron sulphurets, which carry gold. W. A. Poole, of Grub Gulch, owner.

*Caledonia Mine* (Quartz).—In Potter Ridge District. The vein, in the two open cuts, varies from 1 to 1½ ft., showing free gold. D. McClellan et al., of Coarse Gold, owners.

*Canady Mine* (Quartz).—This claim is in Sec. 19, T. 10 S., R. 21 E. Two shafts, partially filled with water, expose a 3 ft. ledge, dipping 45° W. in granite. A. J. Cassidy, of Pollasky, Fresno County, owner.

*Caroline Mine* (Quartz).—It is in Swede Gulch, Potter Ridge District. The prospect shaft and sundry open cuts show the vein is about 18 in. wide, carrying some sulphurets. J. Jones and F. C. Nimes, of Coarse Gold, owners.

*Central No. 2 Mine* (Quartz).—On the North Fork of Deadwood Creek; is opened by an 80 ft. tunnel on a 10 in. vein, which shows sulphurets. D. McClellan and C. Melvin, of Coarse Gold, owners.

*Chipmunk (Stargo) Mine* (Quartz).—In Sec. 15, T. 9 S., R. 21 E. D. L. Pray, of North Fork, owner.

*Cliff Mine* (Quartz).—This claim is at Jackass Mountain. Developments consist of 40 and 60 ft. tunnels. The vein varies in width from a few inches to 4 ft. The quartz contains sulphurets, which are roasted in heaps and then worked in an arrastra. P. Ralph, of North Fork, owner.

*Colorado Mine* (Quartz).—This is a N.W. extension of the Caroline. The 15 ft. shaft exposes a vein nearly 2 ft. in width. D. McClellan et al., of Coarse Gold, owners.

*Columbus Mine* (Quartz).—This claim is on the North Fork of Fine Gold Creek, in Potter Ridge District, and is developed by open cuts. J. Morrison and F. Nimes, of Coarse Gold, owners.

*Combination Claim* (Placer).—This is on Fine Gold Creek, and in Sec. 25, T. 9 S., R. 21 E. J. W. Strathan, of Hildreth, owner.

*Contention (Rough and Ready) Mine* (Quartz).—In Hildreth District. Developments consist of a tunnel and drift more than 100 ft. in length, and a shaft 130 ft. in depth. The thickness of the vein varies from a few inches to about 3 ft., and pitches 30° S. The quartz is worked in a horse arrastra. The ore containing the most sulphurets is roasted in heaps. T. Keefe and T. W. Taylor, of O'Neals, owners.

*County View Mine* (Quartz).—It has a tunnel 1,300 ft. long, and a 26 ft. vein between the walls. See our VIIIth Report, p. 213. D. McClellan and Chas. Melvin, of Coarse Gold, owners.

*Crabtree Mine* (Quartz).—This is on the North Fork of Fine Gold Creek, Potter Ridge District. A small shaft and open cuts show a vein about 14 in. wide, carrying free gold. T. Jones, of Coarse Gold, owner.

*Crescent Mine* (Quartz).—The open cut shows a vein about 2½ ft. in width. G. Conklin and H. McCarthy, of Coarse Gold, owners.

*Cross Mine* (Quartz).—Open cuts show a vein about 1½ ft. in width. G. Conklin and H. McCarthy, of Coarse Gold, owners.

*Crystal Spring Mine* (Quartz).—See our VIIIth Report, p. 214. I. M. Knox, of San Francisco, owner.

*Dagmar Mine* (Quartz).—In Potter Ridge District. An open cut shows the vein 18 in. wide. Chris. Petersen and T. Jones, of Coarse Gold, owners.

*Defiance Mine* (Placer).—This is at the Old Adobe crossing on the San Joaquin River. J. Petersen, of North Fork, owner.

*Diana Mine* (Quartz).—This is in Sec. 18, T. 10 S., R. 22 E. There are three tunnels, the longest of which is more than 400 ft. in length. W. R. Hampton, of Pollasky, Fresno County, owner.

*Eighty-four Mine* (Quartz).—In Potter Ridge District. A 20 ft. shaft has been sunk on the vein, which can be traced on the surface, and shows a width of 1 to 8 ft. D. R. McKenzie and F. Rhule, of O'Neals, owners.

*Eighty-six Mine* (Quartz).—It is in Sec. 36, T. 9 S., R. 20 E. The workings consist of four shafts varying from 20 to 100 ft. in depth. The vein is said to be from  $2\frac{1}{2}$  to 7 ft. wide, and pitches about  $50^{\circ}$  N.E. A cross lead intersects the lode, and is about 5 ft. wide, within granitic walls. C. J. Beck, of Zebra, owner.

*Eliza Jane Mine* (Quartz).—This is in Sec. 25, T. 9 S., R. 21 E. The developments consist of five tunnels, which aggregate probably 500 ft. in length, and an 80 ft. incline. The vein varies from 1 to 2 ft., within granitic walls. P. Bazinet, of Hildreth, owner.

*E. R. Daniels Mine* (Quartz).—In Hildreth District. In the 15 ft. shaft the vein is about 1 ft. wide. E. R. Daniels and R. Higgins, of Pollasky, Fresno County, owners.

*Fine Gold Mine* (Quartz).—It is in Fine Gold Gulch, about  $3\frac{1}{2}$  miles N.E. of O'Neals P. O. Mark Anderson, of O'Neals, owner.

*Fine Gold Claim* (Placer).—It is in Sec. 25, T. 9 S., R. 21 E. J. Kirby, of Hildreth, owner.

*First Venture Mine* (Quartz and Placer).—These claims are situated in Sec. 21, T. 9 S., R. 21 E. I. L. Baker, of O'Neals, owner.

*Five Oaks Mine* (Quartz).—This embraces three claims, viz., Sydney, Alpha No. 1, and Eclipse, which adjoin and are in Potter Ridge District. Developments consist of two tunnels 400 and 170 ft. long and two shafts 70 and 40 ft. deep. The vein is 25 ft. wide and dips  $35^{\circ}$  N.E. Five Oaks Mining Company, of San Francisco, owners.

*Fresno Banner Mine* (Quartz).—In Hildreth District. J. Donahoe et al., of Fresno, owners.

*Fresno Enterprise Mine* (Quartz).—It is 4 miles E. of Grub Gulch, on the south side of Fresno River, and on the east slope of a mountain called Potter Ridge. The vein occurs in mica slate, accompanied by granitic dikes. It strikes W. of N. and dips  $80^{\circ}$  E. The upper portion of the vein is bent over by the weight of the mountain, dipping to the W. The quartz is granular and glassy, and contains iron sulphurets. Gay Coats, of Pasadena, Los Angeles County, owner.

On the same side of the mountain is a contact of diabase and mica slate which has never been explored. Southward are some small prospects where the rock is worked in arrastras.

*Grand Central Mine* (Quartz).—In Potter Ridge District. Developments consist of two shafts, one 40 and the other 18 ft. deep. The vein is 18 in. wide, showing sulphurets and free gold. D. McClellan et al., of Coarse Gold, owners.

*Great Eastern Mine* (Quartz).—In Potter Ridge District. The vein is about 15 in. wide. D. McClellan and Chas. Melvin, of Coarse Gold, owners.

*Grub Gulch Region*.—The gold mines here occur in the belt of crystalline schists which extends south into the granite from the Sebastopol Mine, 4 miles S.E. of the town of Mariposa, into Madera and Fresno counties. The west granite areas strike S. across the edges of the slates and schists; the direction of the line of contact is N. 65° to 70° W., and the strike of the slates N. 50° to 60° W., while still east of the area is another, in which the slates strike N. 45° W. The line of contact between these two metamorphic areas is well defined and marks the general course of the principal mineral lode or vein system of the district. The west area consists of mica slates, micaceous sandstones, mica schists, talcose and chloritic schists, and eruptive dikes of granitic character, and a mass of diabase of irregular form. The east series consists of an evenly laminated, firm mica slate, called the "Indian Peak" slate. The veins occur along and near the contact of the mica slates of the east series and the mica schists and magnesian rocks of the west series. Ordinarily the veins form in the west series and strike across the inclosing rocks to the contact, where they turn and follow it or pinch out entirely. The contact is usually accompanied by a crushing and splitting of the rocks along its course, and in this zone are found many seams and bunches of quartz rich in gold. A fact noticeable in this district appears of importance, viz.: That with the exception of the small, short shoots of gold-bearing quartz found in the micaceous and magnesian schists of the contact, no veins of value were found in the rock other than the mica slates. This phenomenon has been observed elsewhere.

*Hall Claim* (Placer).—It is on the North Fork of the San Joaquin. W. Hall, of North Fork, owner.

*Hanover Mine* (Quartz).—This claim is in Sec. 31, T. 9 S., R. 22 E. The workings consist of a shaft and two tunnels. The vein shows an average thickness of about 1 ft., in granitic walls. There is a 5-stamp mill, and hoisting works. See our VIIIth Report, p. 204. H. S. Williams, of Raymond, owner.

*Harrietta Mine* (Quartz).—It is in Swede Gulch, Potter Ridge District. An open cut exposes a 14 in. vein, showing sulphurets. H. McLeran, of Coarse Gold, owner.

*Hawkeye Mine* (Quartz).—This claim is at the head of Swede Gulch, Potter Ridge District. The developments consist of a 200 ft. tunnel and a 60 ft. shaft. The vein varies from 1 to 16 in. in width. D. McClellan et al., of Coarse Gold, owners.

*Henrietta Mine* (Quartz).—This is an easterly extension of the Lottie K, and is on the east bank of Fine Gold Creek, in the Hildreth District. The workings are as follows: A lower tunnel 190 ft. in length, in which the vein varies from a few inches to 2 ft., and dips 40° N. of W. About 60 ft. above there is an incline 70 ft. in depth sunk on the vein. About 50 ft. above the incline there is a 40 ft. tunnel. In this tunnel the vein seen in the lower workings, and a smaller vein running parallel thereto, are exposed. The ore is clean quartz, showing a small amount of sulphurets. The walls are granitic. J. A. Harris and W. Reed, of Pollasky, owners.



*Hesper Claim* (Placer).—This is situated in Sec. 25, T. 9 S., R. 21 E. J. P. Newman, of Hildreth, owner.

*Hildreth and Fresno Mining Districts*.—The dividing line between the Hildreth and Fresno mining districts is Fine Gold Creek, and all the mines in Fresno Mining District are east of it. Many of the mines in these districts are situated near a dike coursing N.E. and S.W., which culminates in a mass of eruptive rock forming the crest of Crook's Mountain, at an altitude of about 2,000 ft. A review of the strike and position of the gold-bearing veins on the southeastern side of the dike shows that they run practically parallel to the dike, and are situated at no great distance from it. It is said that on the northwestern side of the dike the principal leads of pay ore have a course of about N. 74° E., and that although there are strong cross leads, they are usually barren, except at points of intersection, where bodies of high-grade ore are frequently discovered. Those who are acquainted with the deepest workings in the Hildreth District state that the silver value of the ore increases and the gold value wanes as a great depth is reached. In other portions of Fresno and Hildreth mining districts the veins occupy fissures in the granitic rocks; the latter sometimes present a gneissoid structure.

*Hildreth Mine* (Quartz).—This is in Sec. 36, T. 9 S., R. 21 E. The developments consist of a 400 ft. incline, from which stopes extend for about 200 ft. E. The vein is somewhat irregular, and varies from a few inches to 3 ft. in width. The quartz shows but few sulphurets. Heirs of W. Dunphy, deceased, of Hildreth, owners.

*Hoboken Mine* (Quartz).—In Potter Ridge District. The developments consist of a 100 ft. shaft and 60 ft. drift; the vein is from 4 to 6 ft. wide, carrying sulphurets and free gold. The Collector and Treasurer are extensions, having the same features, and all are owned by L. Krohn, of Coarse Gold.

*Homestake Mine* (Quartz).—This is in Sec. 19, T. 10 S., R. 22 E., in Hildreth District. There are two inclines, said to be 115 and 160 ft. deep, respectively, with drifts and stopes leading therefrom; also a shaft 80 ft. deep. The vein is 2 to 6 ft. wide, between granite walls, and dips 45° N.W. Wise & Brennan, of Hildreth, owners.

*Hughes Mine* (Quartz).—It is in Sec. 30, T. 9 S., R. 22 E. Developments consist of tunnels, drifts, etc., probably 500 ft. of work in all. R. Williams, of Hildreth, owner.

*Indian Peak Mine* (Quartz).—South of the Mammoth, and prospected by shallow cuts and trenches. Chas. Ward, of Grub Gulch, owner.

*Jackass Mountain Mines*.—The surface of the country rock in the vicinity of Jackass Mountain presents a smooth and rounded contour. The depression in which Jackass Meadows are situated was no doubt at one time occupied by a chain of small lakes; indeed, a small lake still remains at the southern base of Jackass Mountain. The veins are gold-bearing fissures in granitic and granular quartzose rock, containing some mica, but in which little or no feldspar can be seen by macroscopic observation.

*Joe Mine* (Quartz).—This property is a mile S. of Fresno River, on a high peak 600 ft. above the river. The vein consists of a zone of contorted and shattered mica schists, into which has infiltrated a large amount of quartz in the form of stringers, lenses, and veins; some of the latter are 12 in. in width. The entire mass, 6 to 12 ft. in width,

contains gold. The workings in 1893 consisted of two shafts, one 200 ft., the other 125 ft. deep; a connecting drift, 150 ft. in length, and a drift south of the main shaft at the 100 ft. level. Provided with arrastras. J. Spencer, of Grub Gulch, owner.

*Josephine, Arkansas Traveler, and Gambetta Mines* (Quartz).—They are on the west side of the metamorphic area, half a mile from Grub Gulch. See our VIIIth and Xth Reports, pp. 213, 197, and 202.

*Keefe Mine* (Quartz).—It is in Deadwood Gulch, Potter Ridge District. There is a small shaft and several open cuts, showing a vein 6 in. wide, carrying free gold. T. Keefe, of Coarse Gold, owner.

*Keno Mine* (Quartz).—This adjoins the Melvine, in Potter Ridge District. An open cut shows a 15 in. vein. M. A. Kipperdan and G. G. Murray, of Coarse Gold, owners.

*Last Chance Mine* (Placer).—This claim is at the Old Adobe crossing on the San Joaquin River. J. F. Hutchinson, of North Fork, owner.

*Last Chance Mine* (Quartz).—This claim is in Sec. 14, T. 8 S., R. 21 E. Developments consist of an upper and a lower tunnel, each of which is about 700 ft. in length. In the upper tunnel, which is partly caved in, the vein is 1 to 5 ft. wide and pitches about 60° N.E. The lower tunnel does not appear to have been run on the vein. At this mine there is a 10-stamp mill. See also our VIIIth and Xth Reports, pp. 211 and 201. D. R. McKenzie and F. Rhule, of O'Neals, owners.

*Last Chance Mine* (Quartz).—This is in Sec. 30, T. 9 S., R. 22 E. The vein is 1½ ft. in width, between granitic walls. C. Williams, of Hildreth, owner.

*Laura May Mine* (Quartz).—In Deadwood Gulch and Potter Ridge District. Open cuts expose the vein 1 to 1½ feet in width. The *Montana* is an extension, with same characteristics. Both are owned by D. McClellan et al., of Coarse Gold.

*Lawsuit Mine* (Quartz).—This adjoins the Bazinet, in the Hildreth District. The two tunnels are 200 and 260 ft. in length, and the vein is 1 to 2 ft. wide and dips 45° S.W. P. Bazinet, of Hildreth, owner.

*Lewis Mine* (Placer).—This claim is situated in Sec. 1, T. 10 S., R. 21 E. B. T. M. Lewis, of Pollasky, Fresno County, owner.

*Lillie Mine* (Quartz).—The mine is in Sec. 27, T. 9 S., R. 21 E. There is a shaft 400 ft. deep, with drifts and stopes running therefrom. The vein shows a width of from 2 to 3 ft. between granitic walls. The mill at this mine burned down in 1893. See our VIIIth Report, p. 210. McDonald Bros., of San Francisco, owners.

*Lingo Mine* (Quartz).—This is in Swede Gulch, Potter Ridge District. It is opened by two tunnels, 100 and 60 ft. in length. The vein is about 12 in. wide. J. Lingo, of Coarse Gold, owner.

*Little Willie's Mine* (Placer).—This claim is in Fine Gold Gulch, in Sec. 25, T. 10 S., R. 21 E. G. P. Gunter, of Pollasky, Fresno County, owner.

*Little Wonder Mine* (Quartz).—In Potter Ridge District. There is a 40 ft. incline. The vein varies from 8 to 14 in. in width. The *Crown Point* and *Nondescript* are the same in character, and all owned by D. McClellan and Chas. Melvin, of Coarse Gold.

*Lottie K Mine* (Quartz).—This mine is in Sec. 14, T. 10 S., R. 21 E., on the west bank of Fine Gold Creek. The workings consist of three tunnels, the lowest of which is about 40 ft. above the creek, and is 180 ft. in length. The ledge between the walls is rather more than 3 ft.

wide, and dips  $45^{\circ}$  S.W., and there is a pay streak about 18 in. wide next to the hanging-wall. The middle tunnel is about 90 ft. above the creek, and is 160 ft. in length on the ledge. An incline connects the two tunnels. The middle tunnel has been run on a small vein with high-grade ore, and dips in a similar direction to that of the larger vein, but its angle of inclination is less. The upper tunnel is on the small vein; is about 140 ft. above the creek, and is 150 ft. in length. There is a spring of good water in the mouth of the upper tunnel. J. A. Harris et al., of Pollasky, Fresno County, owners.

*Lucky Day Mine* (Quartz).—It is in Greason Gulch, Potter Ridge Mining District. A shallow shaft shows a vein about 1 ft. wide. T. Kipperdan, of Coarse Gold, owner.

*Lucky Star Mine* (Quartz).—In Hildreth Mining District. R. Stayton et al., of O'Neals, owners.

*Mabel Mine* (Quartz).—The workings consist of an open cut about 45 ft. in width. W. F. Roddick et al., of Fresno, owners.

*Madera Mine* (Quartz).—This claim is in Fresno Mining District. One of the owners states that the developments consist of a 90 ft. incline, and that the vein is about 4 ft. in width, showing sulphurets and free gold. A. Cadoza et al., of O'Neals, owners.

*Mammoth Mine* (Quartz).—This is in King's Gulch, 1 mile N. of Grub Gulch, at the north end of the Mammoth lode. The main vein is 20 to 25 ft. in width, striking N.  $70^{\circ}$  W. and dipping  $45^{\circ}$  N.E. On the foot-wall side are a number of smaller veins, 4 or 5 ft. in width, which strike into the main vein. The hanging-wall of the lode is mica slate; the foot-wall is a much decomposed granitic rock of fine texture, probably granulite. A transverse fracturing of the vein is a very pronounced feature of this portion of the lode. It is probably due to the movement of the country subsequent to the formation of the vein. The Mammoth lode, on the northern end of which the Mammoth Mine is located, has been traced for 15,000 ft., and it may be longer. It is accompanied throughout its entire length by an intrusive granitic dike, the texture of which ranges from felsite to micro-granite and granulite, and south of Fresno River it approaches pegmatite in the coarseness of its crystallization. This dike crosses the vein system in several different places. Since the visit of the field assistant this mine has been developed to a depth of 200 ft., and an electric plant, transmitting power from Fresno River,  $1\frac{1}{2}$  miles, is in operation. Charles Ward, of Grub Gulch, owner.

*Manzanita Mine* (Quartz).—It is in Hildreth District. Developments consist of an 84 ft. incline and open cuts. The vein shows an average width of  $1\frac{1}{2}$  ft. The quartz shows some sulphurets, frequently occurring in bunches. R. P. Brownell, of Hildreth, owner.

*Margarite Mine* (Quartz).—This mine is in Fine Gold Gulch, Hildreth District. Developments are an incline shaft 180 ft. deep, from which a 20 ft. drift has been run on the vein at a depth of 130 ft. The vein shows a width of from 6 to 18 in., and dips to the N.E. At the mouth of the shaft the angle of inclination is about  $25^{\circ}$ , but it increases to  $60^{\circ}$  at the bottom of the workings. The quartz is somewhat decomposed, and the harder portions show a few sulphurets. Chas. Baker et al., of O'Neals, owners.

*Mary Flower Mine* (Quartz).—This claim is on the southeast branch of Fine Gold Creek, in Hildreth District. The tunnel is 200 ft. long, and the ledge is from 2 to 3 ft. wide.



*Miller & Holt Mine* (Placer).—It adjoins the Hall claim on the north. Miller & Holt, of North Fork, owners.

*Miller, L. H., Mine* (Quartz).—This claim is in Sec. 19, T. 10 S., R. 21 E. It has an incline 40 ft. deep. The vein is about 18 in. in width, and dips 50° S.W. between granitic walls. L. H. Miller et al., of Polasky, Fresno County, owners.

*Mint Mine* (Quartz).—It is in Swede Gulch, Potter Ridge District. Chris. Petersen and T. Jones, of Coarse Gold, owners.

*Monitor Mine* (Quartz).—This is in Cabin Gulch, in T. 7 S., R. 20 E. The shaft is only 25 ft. deep. Chris. Petersen and J. Krohn, of Coarse Gold, owners.

*Morning Star Mine* (Quartz).—It is in Deadwood Gulch, Potter Ridge District. There are two shafts: one 30, the other 60 ft. deep. The vein is narrow, averaging 10 in. wide. J. Hitchcock, of Oakland, Alameda County, owner.

*Morrow Mine* (Quartz).—See Bazinet Mine.

*Mountain Lily Mine* (Quartz).—It is in T. 7 S., R. 21 E. Open cuts show a vein 2½ ft. wide. D. L. McClellan and C. Melvin, of Coarse Gold, owners.

*Mountain View Mine* (Quartz).—This mine is situated in Sec. 6, T. 9 S., R. 21 E., and has three shafts, varying from 50 to 100 ft. in depth, and drifts from the bottom of the shafts, the longest of which is 290 ft. The ore is gold-bearing quartz, some of which is heavily sulphuretted. The width of the vein varies from 2 to 6 ft. The walls are granitic. See our Xth Report, p. 198. This mine was reopened in May, 1894, 14 men being employed. J. Donahoe et al., of Fresno, owners.

*Mud Springs (Wilson) Mine* (Quartz).—This claim is in Sec. 26, T. 9 S., R. 21 E. The workings consist of an incline 300 ft. deep. The vein has an average width of about 16 in. S. H. Wilson, of O'Neals, owner.

*Muhly Mine* (Placer).—It is on the North Fork of the San Joaquin. T. Muhly, of North Fork, owner.

*Nellie Gray Mine* (Quartz).—It is in Sec. 14, T. 9 S., R. 21 E. The vein is only a few inches in thickness, but the ore is very rich. The walls are granitic. J. H. Oester, of O'Neals, owner.

*Never Sweat Mine* (Placer).—It is in Sec. 1, T. 10 S., R. 21 E. J. A. Harris, of Pollasky, Fresno County, owner.

*New Citizen Mine* (Quartz).—It is in Deadwood Gulch, Potter Ridge District. It is opened by a 100 ft. shaft and a 180 ft. tunnel, the vein showing a width of about 5 ft. About a mile from the mine there is a stamp mill and two concentrators. C. A. Lea et al., of Plainsville, New Jersey, owners.

*North Lillie Mine* (Quartz).—An extension of the Lillie, in Hildreth District. F. Wetmore, of O'Neals, Fresno County, owner.

*Overlooked Mine* (Placer).—It is in Sec. 31, T. 9 S., R. 22 E. J. H. Morris, of Hildreth, owner.

*Owl Mine* (Quartz).—The mine is on Jackass Mountain. There is a tunnel about 400 ft. in length, and stopes from same. The vein shows a width of from a few inches to 2 ft., dipping 50° N.W. The clean quartz carries iron sulphurets and a little galena. See the Waterloo Gold Mining Company in our XIth Report, p. 216. G. D. Hitchcock, of Madera, owner.

*Paymaster Mine* (Quartz).—This claim is in Sec. 15, T. 8 S., R. 21 E. The tunnel is over 900 ft. long, but partly caved in; there is an 80 ft.

shaft. The vein is said to be from 1 to 20 ft. in width, showing sulphurets. There is a 10-stamp mill on this claim. Waterloo Gold Mining Company, of San Francisco, owners.

*Paterson Mine* (Quartz).—This is a westerly extension of the Mud Springs Mine, in the Hildreth District. There are two shafts, one 140 ft. deep, the other 90 ft. J. Keating, of O'Neals, owner.

*Pine Grove Mine* (Quartz).—This mine is about 7 miles E. of the North Fork of the San Joaquin River. The workings consist of a 130 ft. tunnel, partly caved in, and several open cuts. The ledge in the tunnel shows a width of about 2 ft. In the open cuts the lead pitches N.E., but in the tunnel the vein has a S.E. pitch; the angle of inclination, both in the cuts and in the tunnel, is less than  $25^{\circ}$ . The ore is decomposed quartz and clayey matter; it is worked in an arrastra operated by water power. The walls are disintegrated granitic rock. Jas. Lawson, of North Fork, owner.

*Plain View Mine* (Quartz).—This claim is in Coarse Gold Gulch, Potter Ridge District. In the 8 ft. shaft and an open cut, the vein is 18 in. wide. F. Mello and J. Elam, of Coarse Gold, owners.

*Pray Mine* (Quartz).—It is in Fine Gold Gulch, Hildreth District. There is an open cut about 12 ft. deep. The vein, showing free gold, is about 6 in. wide and dips  $60^{\circ}$  N. It is a free-milling ore. The walls are granitic. D. L. Pray et al., of O'Neals, owners.

*Prospect Mine* (Quartz).—This claim is in Swede Gulch, Potter Ridge District. The vein is 18 in. wide. Chris. Petersen and Theo. Jones, of Coarse Gold, owners.

*Prospect Mine* (Placer).—This is in Sec. 35, T. 9 S., R. 21 E. Chris. Petersen et al., of Hildreth, owners.

*Providence Mine* (Quartz).—The claim is in Deadwood Gulch, Potter Ridge District. One of the owners states that the developments consist of a tunnel more than 800 ft. in length, and that the ledge is 20 ft. between the walls. D. McClellan and Chas. Melvin, of Coarse Gold, owners.

*Quartz Mountain (Mine d'Or de Quartz Mountain) Mine* (Quartz).—This mine is situated in T. 8 S., R. 21 E. There is a 60-stamp mill and hoisting works on the property. See our VIIIth Report, p. 210. J. Dunn, of San Francisco, owner.

*Rifle Mine* (Placer).—It is in Sec. 26, T. 9 S., R. 22 E. W. W. Poole, of Hildreth, owner.

*Riverside and Starlight Claims* (Quartz).—These are S.E. of Indian Peak Mine, and half a mile E. of Grub Gulch. Considerable work has been done at the joining line of these claims. Six veins 1 to 4 ft. wide, striking into the contact, have been exposed in cuts and small shafts. One tunnel is run some distance into the mountain on the contact; a winze sunk in the tunnel is in the ore. Some of this quartz yields in the mill from \$40 to \$200 per ton. The hanging-wall is the "Indian Peak" slates; the foot-wall, mica schist. The main vein at contact is 4 ft. wide; it dips with the hanging-wall slates. Southerly from this point are two claims on which no work was done. Chas. Ward, of Grub Gulch, owner.

*Round Tree Mine* (Quartz).—This mine is in Sec. 6, T. 10 S., R. 22 E. The workings consist of a 30 ft. incline. The vein is about 8 in. wide. E. D. Topping, of Hildreth, owner.

*Runaway Mine* (Quartz).—This mine is in Sec. 30, T. 9 S., R. 22 E. Developments consist of a 100 ft. incline. The vein is from 2 to 4 in. in width. The walls are granitic. R. Williams, of Hildreth, owner.

*San Joaquin Mine* (Quartz).—The claim is in Sec. 26, T. 10 S., R. 21 E. The workings consist of an upper tunnel about 40 ft. long, and a lower tunnel, which is about 50 ft. long; a winze has been sunk to a depth of 30 ft. in the latter tunnel. The vein is about 18 in. wide and dips about 70° N.W. J. A. Harris et al., of Pollasky, Fresno County, owners.

*San Joaquin Mine* (Quartz). This mine is in Sec. 7, T. 10 N., R. 22 E. There are three tunnels; the lower is 480 ft. long. An upraise connects the middle and the upper tunnel. The ledge varies from 6 in. to 2 ft. in width, and dips 50° N.W. Geo. Sym, of Hildreth, owner.

*Savannah (Atlanta) Mine* (Quartz).—This is the first claim on the Mammoth lode south of the Fresno River, and is 1½ miles S.E. of Grub Gulch. The vein is 4 to 6 ft. wide, and lies entirely within the "Indian Peak" slates. The contact is here obscure. The vein dips 50° N.E. The dike of granulite in this claim cuts through the main shaft, displacing the vein. At the northern end of the claim the dike is 100 ft. distant in the hanging-wall, and is nearly vertical. The vein does not appear to have faulted, being simply displaced by the dike. The quartz at the bottom of the 100 ft. shaft showed a distinctly banded structure, greatly resembling the cleavage of the inclosing slate. It is highly probable that this vein represents a silicification of the slates along the zone of fracture, the silicates of alumina and magnesia being replaced by quartz, iron sulphurets, and gold. The vein quartz often shows a quantity of chloritic matter, altered from the biotite mica of the slates. The quartz is granular and vitreous, but frequently shows gold. A 10-stamp mill was in course of construction in May, 1893. J. E. Spencer, of Grub Gulch, owner.

*S. E. Canady Mine* (Quartz).—This is a southeastern extension of the Canady Mine. There is an open cut about 40 ft. in length and 5 ft. deep. The vein, showing sulphurets, is about 8 in. in width, and dips 45° W. S. E. Canady & Bro., of Pollasky, Fresno County, owners.

*Seneca Mine* (Placer).—This claim is in Sec. 25, T. 10 S., R. 21 E. Seymore May, of Pollasky, Fresno County, owner.

*Sequin Mine* (Quartz).—This prospect is in Potter Ridge District. In the 12 ft. shafts and open cuts, the vein is 1 ft. wide. D. McClellan and Chas. Melvin, of Coarse Gold, owners.

*Smultz Mine* (Quartz).—In Hildreth District. There is a tunnel about 80 ft. in length and a shaft 40 ft. deep. The vein averages about 1 ft. in width, and dips 40° N.W. Smultz Bros., of Fresno, Fresno County, owners.

*Snow Flake Mine* (Quartz).—This is a southwestern extension of the Baltimore. It is opened by a 375 ft. tunnel. The vein shows a width of from a few inches to about 2 ft. The vein dips 60° N.W. The ore is mixed with clayey matter, the harder portions showing sulphide of iron and a little galena. Smith Norris, of Fresno, owner.

*Standard Mine* (Quartz).—The claim is in Sec. 14, T. 9 S., R. 21 E. Developments consist of a 135 ft. incline, a 25 ft. drift, and a tunnel 35 ft. in length. The width of the vein varies from a few inches to 4 ft. The vein, which shows some sulphurets, dips 30° S. T. S. Baker and G. W. Keller, of O'Neals, owners.



*Standard No. 2 Mine* (Quartz).—An extension of the Lingo Mine. The developments consist of a 60 ft. tunnel and open cuts. The vein, showing free gold, averages about 16 in. in width. D. McClellan and Chas. Melvin, of Coarse Gold, owners.

*Starbuck Mine* (Quartz).—This is in Fine Gold Gulch, Hildreth District. It is opened by a tunnel 40 ft. long and several open cuts. The vein is 6 in. wide and dips 30° N.E. The walls are granitic. Mark Anderson, of O'Neals, owner.

*Stemwinder Mine* (Quartz).—This claim is on Jackass Mountain. The tunnel is about 35 ft. in length and the shaft 20 ft. deep. The vein is about 18 in. wide and dips 20° W. Smith Norris, of Fresno, owner.

*Sunol Mine* (Quartz).—It is in Sec. 36, T. 7 S., R. 20 E., in Potter Ridge District. The shaft is 100 ft. deep and the ledge 2 ft. wide, dipping 45° E. The *Antonia*, *Headlight*, and *Meta* are extensions, and are owned by J. Krohn, of Coarse Gold.

*Surprise (Old Jackass Brown) Mine* (Quartz).—It is on Jackass Mountain. There is a shaft 40 ft. deep, a tunnel 100 ft. long, and open cuts. The vein shows a width of a few inches, and dips 60° S.E. B. Norris, of North Fork, owner.

*Swede Gulch Mine* (Quartz).—This mine is in Swede Gulch, Potter Ridge District. The shafts are 20 ft. and 14 ft. deep. The vein shows a width of from 2½ to 3 ft. F. A. Cornell, of San Francisco, owner.

*Telles & Morton Mine* (Placer).—The claim is in Sec. 12, T. 8 S., R. 22 E. The claim is leased to a Chinese company. J. M. Telles and J. R. Morton, of North Fork, owners.

*Texas Flat Mine* (Quartz).—This is in Secs. 7 and 8, T. 8 S., R. 21 E. See our VIIIth Report, p. 212. J. B. Haggin et al., owners.

*Tiger Mine* (Quartz).—It is half a mile S. of Grub Gulch. It is a small fissure vein, striking nearly E. and W. and dipping N. It varies from a small crevice to 3 ft. in width. A large dike of felsitic rock is always associated with the vein, though not always in contact with it. The vein contains large amounts of coarsely crystalline dolomite, and occasionally a green scaly mineral, similar in appearance to mariposite. The quartz is massive, and contains gold and silver, and sulphurets of iron, lead, and zinc. W. A. Poole, of Grub Gulch, owner.

*Triangle Mine* (Placer).—In Sec. 26, T. 9 S., R. 21 E. J. D. Jones, of North Fork, owner.

*Unmitigated Mine* (Quartz).—This adjoins the Columbus on the north. The shaft is 50 ft. deep. The vein varies from 8 to 14 in. in width. J. Morrison and F. C. Nimes, of Coarse Gold, owners.

*Viana Mine* (Quartz).—In the Hildreth Mining District. There is a 400 ft. tunnel on the property. W. R. Hampton, of Pollasky, Fresno County, owner.

*Vienna Mine* (Quartz).—In Potter Ridge District. The work consists of open cuts. F. Dutchman et al., of Coarse Gold, owners.

*Volcano No. 1 Mine* (Quartz).—This is at Hildreth, in Sec. 26, T. 19 S., R. 21 E. There is a 130 ft. incline, with drifts from same. The vein shows about 12 in. and dips N.W. A new tunnel has struck the vein at a lower elevation than that of the old workings. The quartz shows a few sulphurets, and prospects well in the horn. W. Beck and Chas. O'Neal, of O'Neals, owners.

*Washington Mine* (Quartz).—This is in Deadwood Gulch, Potter Ridge District. It is opened by cuts, from which a large amount of decom-

posed quartz has been "sluiced out"; also by a 20 ft. shaft. The vein is about 2 ft. wide, and shows free gold. D. McClellan et al., of Coarse Gold, owners.

*Willow Creek Mine* (Quartz).—This claim is in Sec. 21, T. 9 S., R. 21 E. Developments consist of shafts and open cuts, which in May, 1894, were partially filled with water. The vein is claimed to be 4 ft. wide; the walls are granitic. Charles O'Neal, of O'Neals, owner.

*Wilson Mine* (Quartz).—See Mud Springs.

*Zebra Mine* (Quartz).—It is in Fresno District. Developments consist of tunnels and shafts, in all about 1,000 ft. of excavations. The vein shows a width of from 10 in. to 2 ft.; the walls are granitic. See our VIth, VIIIth, and Xth Reports, pp. 210 and 199. Zebra Mining Company, owners.

#### GEOLOGY OF A PORTION OF MADERA AND MARIPOSA COUNTIES.

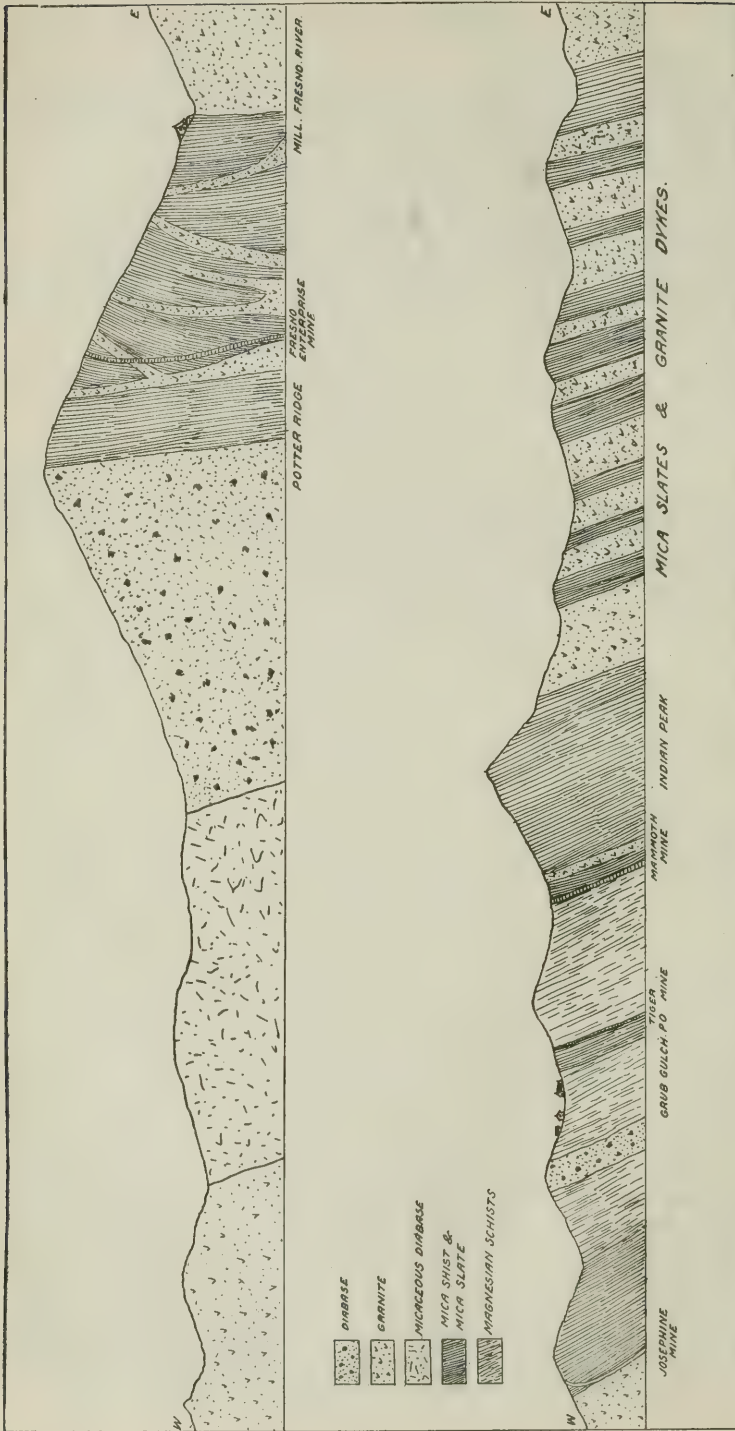
By W. H. STORMS.

The geology of the region lying a few miles on either side of the Madera-Mariposa county line is unusually interesting, as in this section the great "Mother Lode" finds its southern termination and a new series of mineral zones takes its place southward.

The broad belt of slates and schists, commonly called the "auriferous slates," which flank the western slope of the Sierra for more than 200 miles, in Mariposa County split up into comparatively narrow arms, which extend southeastward far into the granite, the great masses of which replace the massive intrusions of diabase and diorite which occur northward.

All along the granite contact the slates and schists are found greatly disturbed, indurated, and contorted into folds, with greatly varying strike and dip.

There are five distinct belts of slaty and schistose rocks reaching southeast into the granitic area. On the west is that from the vicinity of Hornitos through the Buchanan copper district toward Hildrethville and beyond. This belt varies from 12 miles at the north end to 3 or 4 miles at the south. Its western boundary, as far as exposed, is the Quaternary deposit of the San Joaquin plain. Eastward a granite zone 8 to 12 miles wide separates this west slate belt from that which reaches from 4 miles southeast of the town of Mariposa through to Grub Gulch, in Madera County, and south into Fresno County. The eastern border of this second slate area is greatly disturbed, the slates and schists being interstratified with broad and narrow dikes of granite, diabase, and other eruptive rocks. These granite dikes unite on the north, and the granite sends an arm several miles to the north reaching to Mount Bullion. Still farther east a third zone of schists extends from Buckingham Mountain, in Mariposa County, through Potter Ridge, in Madera County, into Fresno County. This belt is not more than a mile in width. Eastward again is found granite in a narrow belt; it is highly metamorphic, commonly showing a gneissoid and sometimes a porphyritic structure. East of this lies the belt of black slates, schists, and limestone of the Hite's Cove region. A large lens-like mass of granite has been thrust into these rocks on the north side of the Middle Fork of the Merced River. It is about 1 mile in length and half a mile



GEOLOGICAL CROSS - SECTION 18,000 feet from JOSEPHINE MINE GRUB GULCH P.O. East to FRESNO RIVER at ENTERPRISE.  
MILL. MADERA CO. CAL.



wide. It appears to be entirely surrounded by the schists. The Hite's Cove metamorphics extend several miles to the southeast through the Silver Peak region and beyond. East of these is a succession of granitic and highly metamorphic areas, which include many broad masses of diorite, which have their neucleal mass in Mount Raymond.

The details of this complex geological field would be best illustrated by a map showing these formations.

The "Mother Lode" ends in the southern part of Mariposa County, a description of the detailed geology of which will be found in our Xth Report, p. 25. Each of the arms of slaty and schistose rocks which extend south includes a series of mineral veins having well-defined characteristics, and differing in every particular from the veins of the "Mother Lode."

The veins appear to have been formed subsequent to the intrusion of the granite. Dikes of granitic type, viz., felsite, felstone, granulite, aplite, and pegmatite granite, commonly accompany the veins of this region, and in some cases may be traced directly to the large granitic masses of the neighborhood. It is not improbable that the intrusive mountain masses and smaller dikes of diorite and diabase are also subsequent to the eruption of the granite.

It is generally supposed, and has frequently been asserted, that the metamorphic rocks of the auriferous series represent an unbroken formation; that the cleavage planes and sedimentary planes are identical. The occurrence of conglomerate rocks would suggest unconformability, though none has ever been observed.

At the old townsite of Carson, in Mariposa County, are acres of slaty tailings of the early placer mining. Everywhere may be found slates with fine cleavage, on the smooth faces of which may be seen what are undoubtedly lines of sedimentation. These lines cross at nearly 90°; southward, however, this angle is somewhat less. This would indicate that Carson is about the axis of the fold.

#### MARIPOSA COUNTY.

Though the mineral resources of this county, chiefly gold, are large, this industry is not in a flourishing condition, owing to the fact that the greater portion of the mining territory is covered by two vast private properties, viz.: The Mariposa, or Fremont Grant, and the Seth Cook estate, and that still another large tract embracing mineral land—the Yosemite Park—retards mining operations. Within the past two years, however, the Mariposa estate mines have been investigated by the owners with a view of resuming operations, and negotiations for the transfer of the Cook estate are said to be pending. The indications now are that "old Mariposa" is on the eve of a mining boom.

*Barley Field Mine* (Quartz).—It is 4½ miles N.E. of Mariposa, near the Champion. The vein occurs in granite.

*Bandarita Mine* (Quartz).—It is 12 miles E. of Coulterville, on the North Fork of Merced River, and is on the "East Lode." Geologically it is similar to the Hite Mine. C. L. Mast, of Coulterville, Superintendent.

*Bondurant Mine* (Quartz).—It is on the "East Lode," 11 miles N.E. of Coulterville. See our Xth Report, p. 345. Idle. Bondurant Gold Mining Company, of St. Louis, Missouri, owners.

*Black Bart Mine* (Quartz).—It is situated on a spur of the Buckthorn Mountain, 11 miles E. of Coulterville. The fissure strikes E. and W., dipping 25° N. It occurs in splintered diabase, and is accompanied by a light-colored, granular dike rock. The quartz varies from a seam to 3 ft. in width. It is often found interstratified with the dike. The miners find, by experience, that the softening of the dike, together with the appearance of much iron and scales of chloritic mineral, are indications of the proximity of a "pocket" of gold. There are several claims on this vein, but this was the only one working in 1893. S. B. Sample, of Coulterville, owner.

*Campodonica Mine* (Quartz).—It is 1 mile E. of Hornitos. Campodonica Mining Company, of Hornitos, owners.

*Champion Mine* (Quartz).—Described in our Xth Report, p. 303. Jas. Ridgeway, of Mariposa, owner.

*Cherokee Mine* (Quartz).—This claim is 9 miles E. of Coulterville, and contains two parallel veins, 30 ft. apart. Jas. Shimer, of Coulterville, owner.

*Congo Mine* (Quartz).—It is 4 miles E. of Coulterville. A cross-cut tunnel 300 ft. in length has cut the vein 200 ft. from the surface. The vein is in slate, near diabase, and strikes N.W., dipping 50° N.E. John Metzger & Co., of Coulterville, owners.

*Coulterville District*.—Two great veins branch out in the Pine Tree and Josephine mines and extend northwestward to and beyond Coulterville. These veins are locally known as the Pine Tree or "Mother Lode," and the Josephine or "West Lode." See our Xth Report, p. 35. The principal claims on the "Mother Lode" between the Pine Tree Mine and Coulterville are the Daliah, Louisa, Mary Harrison, and Virginia. On the "West Lode" are the Tyro, Malvina No. 1 and No. 2, and the Potosi.

*Cranberry Mine* (Quartz).—It is on the North Fork of Merced River, 4 miles N. of Hite's Cove. See our VIIIth Report, p. 348.

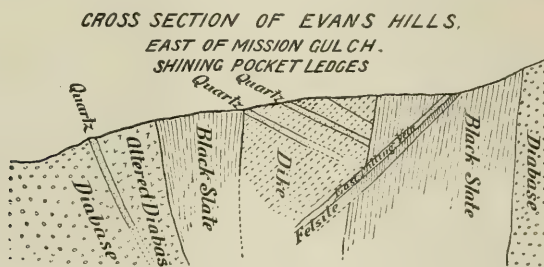
*Daliah Mine* (Quartz).—It is on the "Mother Lode," 2½ miles S.E. of Coulterville. See our VIIIth and Xth Reports, pp. 346 and 41. General Boyd, of San Francisco, owner.

"*East Lode*."—About 16 miles east of the "Mother Lode," and extending for a distance of 80 miles N.W. from Hite's Cove, is a gold-bearing belt or lode system of great importance (having produced about \$10,000,000), locally known as the "East Lode." The principal mines in this belt are the Ferguson, Hite, and Kanaka mines, in Mariposa County; Buchanan, Dead Horse, Eureka, Keltz, and Soulsby in Tuolumne County; Sheep Ranch, in Calaveras County, and Clinton Mine, near Pine Grove, in Amador County. These mines, and many others, occur in a zone a mile or more in width. The southern end is entirely in slate and the northern portion entirely in granite. The veins have a greatly varying strike and dip; the general trend of the veins, however, is to the W. of N., and the dip to the E. In some parts of the lode the fissure is represented by one main crevice with many branches, while in other portions there are two or three separate fissure systems, as in the North Fork of Tuolumne River, between the Buchanan and Eureka mines. The lode is distinguished by the branching character of the fissures, the inclusion of slaty material in the quartz, and usually by a banded structure of the veins. These mines have nearly all been described in former reports of the State Mineralogist, particu-

lar reference to which has been made elsewhere. The Hite Mine has been selected as a type of the mines of the "East Lode," and also as one embracing many features that are common to fissures found in mica slates and micaceous schists.

*Elizabeth Mine* (Quartz).—It is on the Mariposa estate, 4 miles S.W. of Bear Valley P. O. The vein occupies a crevice in a dike of basic rock. It strikes N. and dips  $50^{\circ}$  E. Mariposa Estate, owner.

*Evans Mine* (Quartz).—This is 1 mile N.E. of the town of Mariposa, near Missouri Gulch. A very interesting geological cross-section is found here. On the W., in diabase, is the Missouri Gulch vein, which enriched every gulch crossing it or leading up to it. The superficial placer deposits were worked out years ago, and a large amount of gold has since been taken from the vein in the form of "pockets." The strike of the vein is N. and dips  $70^{\circ}$  E. The diabase of the hanging-wall is succeeded eastward by black slates, which in turn give place to a dike or mass of decomposed rock, which is probably of the granite family. On the east side of this dike the black slates are again found, and still beyond these a diabase. In the eastern slate belt is a well-defined fissure vein striking N.W. and dipping  $45^{\circ}$  S.W. In the eruptive dike occupying the center of this area is found a system of fissures filled with quartz con-



taining gold. The surface of the soft, decomposed dike was long since sluiced off with large profit. What relation these several fissures bear to one another is not apparent in the present stage of development.

*Farmer's Hope Mine* (Quartz).—It is 6 miles N. of Mariposa. See our Xth Report, p. 308.

*Ferguson Mine* (Quartz).—It is on the "East Lode," 17 miles N.E. of Mariposa.

*Green Gulch Mine* (Quartz).—It is on the Mariposa estate, half a mile W. of Princeton. Mariposa Estate, owner.

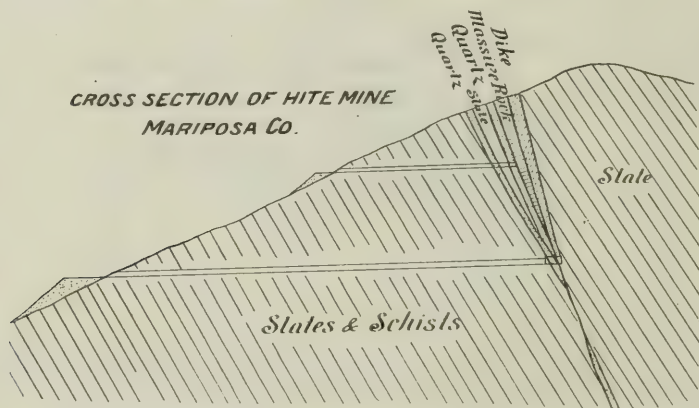
A *Gold Belt* extends along the ridge overlooking the South Fork of the Merced River, 2 miles S.W. of Hite's Cove. The slates are hard and dense, and are traversed by dikes of felsitic rock, great and small. They are highly charged with iron oxides, but appear never to have been prospected. As the gulches leading up to this belt, which is a mile in width, have produced coarse gold in considerable amount, it seems a promising field for energetic prospecting. Wood and timber are abundant, but water is rather scarce, though small springs occur quite commonly in gulches near this belt.

*Hasloe Mine* (Quartz).—It is 12 miles E. of Coulterville, in Gentry's Gulch. It has been considerably developed. John Morgan, of San Francisco, owner.



*Hayseed Mine* (Quartz).—It is 6 miles N.E. of Mariposa, adjoining the Farmer's Hope. Idle. See our Xth Report, p. 308.

*Hite Mine* (Quartz).—This is situated on a rugged ridge between the South and Middle Forks of the Merced River, 16 miles N.E. of Mariposa. The altitude at the river near the mine is 1,900 ft. The surrounding hills rise 1,600 to 4,000 ft. above the cañon bottom. The rocks are all of a slaty or schistose nature, but are much contorted, faulted, and indurated by pressure. Dikes of dioritic and felsitic rocks are found cutting through these metamorphosed rocks. The great fissures of the Hite Mine strike along the ridge N. 70° W., crossing it at an altitude of 3,500 ft., and continuing on its northern side. The fissure maintains a remarkably straight course for a long distance. The main, or hanging-wall, crevice dips 75° to 80° N. The principal workings on this system of fissures are in the Hite Mine. A limited amount of prospecting has been done on other portions of the vein. The veins for the most part lie between walls of black slate, which in every physical feature resembles the slates of the "Mother Lode." The main fissure is accompanied by a dike of light gray felsitic rock, which usually lies in contact with or near the vein on the hanging-wall side. The normal con-



dition of the slate is that of an easily cleavable, dark, grayish slate, classed as *argillite*. Whenever this rock presents a perfect, slaty cleavage, it is always at some distance from a fissure, but on nearing a crevice the slate becomes foliated, soft, black, and shining, but no degree of foliation or contortion in the slates indicates pay rock, for these conditions obtain when no quartz at all, or perhaps barren quartz, is found. The Hite fissure is a branching crevice, with spurs thus far developed chiefly in the foot-wall. A segment of slate, split off from the main fissure on the foot-wall side, has the form of the lower half of a great plano-convex lens having a base of about 600 ft. and a maximum thickness of 45 ft. This segment of slate is surrounded by quartz. Neither the hanging-wall fissure nor that in the foot-wall slate is continuously filled with quartz. At times these fissures contain only barren quartz, or crushed slate with no quartz. In width the veins range from a mere seam to 12 ft., and at the point of convergence in depth there was found pay quartz of 25 ft. in width.

Going eastward from the main workings a long drift has been run, which frequently shows the vein to split and send off shoots or crevices into the hanging-wall side; indeed, it is sometimes difficult to say which is the main fissure. The quartz commonly includes more or less slaty material, and in places exhibits a banded structure, and rock of this character was uniformly good. These appear to be the chief characteristics of the Hite Mine, and they are common to most of the mines of the "East Lode," and in fact to most mines in the slate rocks elsewhere.

The developments were described in our VIIIth Report, p. 344. For some distance down the incline winze, the vein continued large and massive; lower it stratified and was lost, only the fissure filled with crushed black slate remaining. A drift was run eastward on this crevice at the bottom of the winze, 900 ft. from the surface. Some distance from the station a cross-cut into the hanging-wall disclosed 14 ft. of solid quartz and no wall. This rock was very low grade, but it was also a long way east of the pay shoot which had been followed down from the surface and which pinches westward, its lower limb passing just below the station level at the top of the winze.

It has been shown in a number of instances in mines in the slate rocks of Amador County that the disappearance of pay quartz at any point between the surface and 1,000 ft. does not prove that the lower levels are destitute of pay rock. This fact is particularly exemplified in the Kennedy and Hardenburgh mines, in Amador County. John Hite, of San Francisco, owner.

*Hornitos District* lies in that belt of crystalline schists which extends from the plains of the San Joaquin into the first low-lying foothills, in the western part of Mariposa County. The mining industry, once prominent, is now almost at a standstill, only one mine being in operation.

*Josephine Mine* (Quartz).—It is on the Mariposa estate. See Pine Tree and Josephine. Mariposa Estate, owner.

*Juniper Mine* (Quartz).—This is  $1\frac{1}{2}$  miles W. of Bear Valley. It occurs at a contact of slate and diabase on the surface, but in depth the fissure passes into the slates. The quartz is hard and massive, and carries sulphides of iron, lead, and zinc. A dike of felsitic rock accompanies the vein.

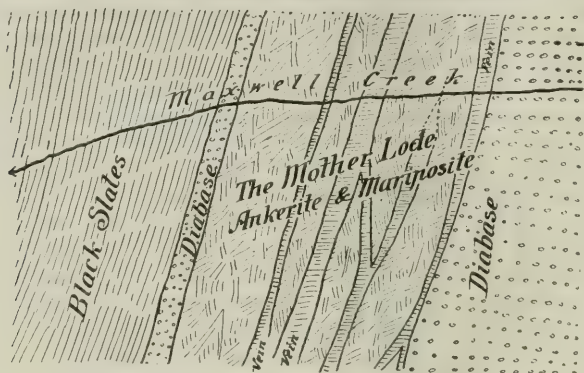
*Kanaka Mine* (Quartz).—It is 7 miles E. of Groveland. It is equipped with a 10-stamp mill. In operation in 1893. Louis Casretto, of Groveland, owner.

*Lacy (Talc) Mine* (Pocket).—It is 7 miles N.E. of Mariposa. See Xth Report, p. 304. Working in 1893. Geo. Lacy, of Mariposa, owner.

*Louisa Mine* (Quartz).—This is on the east side of Maxwell Creek, just below the town of Coulterville. It appears to present all those features which characterize this portion of the "Mother Lode" as far north as Carson Hill, in Calaveras County. Where the lode crosses the creek it has a width of 300 ft. The lode consists of a great mass of ankerite and mariposite, including a reticulated mass of quartz veins, large and small. On the east or hanging-wall side of the lode is massive diabase, and on the foot-wall side a dike of diabase separating it from a belt of black slate a mile or more in width. On the east bank of Maxwell Creek is exposed a mass of quartz, 19 ft. wide, 25 ft high, and 300 ft. long. It does not appear on the surface on the opposite side of the creek. A shaft sunk on the vein 60 ft. deep shows its thinning out at that depth; southward from this large mass a small vein branches

out from the main vein and strikes diagonally into the hanging-wall. It increases in size northward. Through the center of the lode is seen a large vein, 10 to 20 ft. wide, and west of it another well-defined but smaller vein. The western portion of the ankerite-mariposite area is filled with a net-like system of small veins and bunches of quartz. These small stringers also occur in greater or less abundance in those parts of the lode included between the larger veins of quartz.

**HORIZONTAL SECTION OF THE MOTHER LODGE  
AT THE LOUISA MINE near COULTERVILLE**



The feature of the greatest interest is the occurrence of two large veins near the center of the lode, connected by a third vein which crosses the lode diagonally, forming a letter "N." The two large veins are about 120 ft. apart. Southeastward all the large veins appear to trend toward a common point, forming a large exposure of quartz nearly 100 ft. wide at the top of the hill. Considerable gold can be seen in the quartz of the "N"-shaped system of veins. Gold also occurs in the mariposite and ankerite in shoots, accompanied by veinlets and bunches of quartz. When the ankerite is solid, without quartz or a brecciated appearance, the quantity of gold contained is too small to pay. General Boyd, of San Francisco, owner.

*Malvina Mines Nos. 1 and 2 (Quartz).*—They are on the "West Lode,"  $1\frac{1}{4}$  miles S.W. of Coulterville, and are the south extension of the Potosi. On the No. 2 the shaft was retimbered in 1893, but no development was done. See our VIIIth and Xth Reports, pp. 347 and 39. Cook Estate, Coulterville, owner.

*Mariposa Estate Mines (Quartz).*—These are all idle and have been for several years past. The principal mines are the Elizabeth, Green Gulch, Josephine, Mariposa, Mount Ophir, Mexican, Pine Tree, and Princeton. See our VIIIth and Xth Reports, pp. 343, 33, 37, and 309. Mariposa Mining and Commercial Company, San Francisco, 224 California Street, owners.

Attention is called to an important difference between the mines along this portion of the "Mother Lode" and those in portions of Calaveras and Amador counties. In Mariposa County the veins occur entirely in the black slates, accompanied by dikes of diabase or dikes of granitic type. Northward the mines are associated with great masses of diabase.



In the greater portion of Calaveras County the veins occur entirely in the diabase; in the southern part of Amador County, at the contact of diabase and slate; and in the northern part of Amador County in the slate area, with small dikes similar to those of the southern part of Mariposa County. In this southern section no great mines are found at the contact of diabase and slate like those at Jackson, Sutter Creek, Amador City, and Drytown. A few "pocket veins" only occur at the "contact" in Mariposa. Gold-bearing veins occurring entirely within the diabase area in Mariposa County usually have a course nearly at right angles to the strike of the "Mother Lode."

*Mariposa Mine* (Quartz).—It is in Mariposa. Caved and inaccessible. Belongs to the Mariposa Estate.

*Mary Harrison Mine* (Quartz).—It is on the "Mother Lode," 2 miles S.E. of Coulterville. See our VIIIth and Xth Reports, pp. 346 and 41. Cook Estate, of Coulterville, owner.

*Martin-Walling Mine* (Quartz).—It is 8 miles E. of Coulterville. P. P. Mast, of Springfield, Ohio, owner.

*McAlpine Mine* (Quartz).—This is on the "Mother Lode" near the Tuolumne County line. See our Xth Report, p. 44. General Boyd, of San Francisco, owner.

*Mexican Mine* (Quartz).—It is 1 mile S.W. of Bear Valley P. O., on the Mariposa estate. Mariposa Estate, owner.

*Mexican's Mine* (Quartz).—It is  $1\frac{1}{2}$  miles W. of Bear Valley P. O., and is the west extension of the Sirocco. It was being worked in a small way in 1893.

*Missouri Gulch Mine* (Quartz).—It is 1 mile N.E. of Mariposa, on the Mariposa estate. (See Evans Mine.) Mariposa Estate, owner.

*Mount Ophir Mine* (Quartz).—It is on the "Mother Lode," 1 mile N. of Princeton, and belongs to Mariposa Estate. See our Xth Report, pp. 26 and 33.

*Nevada Mine* (Quartz).—This is one of a system of fissures in the diabase of the east slope of Bear Valley Mountain, not far from the summit, and half a mile south of the Bear Valley and Hornitos road. In character the vein resembles that of the Sirocco. It occurs in slaty diabase, much split up, the quartz inclosing masses of the country rock, usually altered to chloritic schist. On these portions of the vein the gold occurs in "pockets," ranging from a few dollars to more than \$500. Hall & McFadden, of Bear Valley, owners.

*No. 9 Mine* (Quartz).—This is  $2\frac{1}{2}$  miles E. of Hornitos. It was worked to a depth of 400 ft., but is now idle. The hanging-wall is mica schist, the foot-wall a felsitic dike. There are still large quantities of low-grade quartz in sight. E. P. Casterline, of Hornitos, owner.

*Oso Mine* (Quartz).—It is on the Mariposa estate, half a mile W. of Bear Valley P. O. Mariposa Estate, owner.

*Peregory & Heiser Mine* (Quartz).—It is  $5\frac{1}{2}$  miles N. of Mariposa. See our Xth Report, p. 308. Idle.

*Pine Tree and Josephine Mines* (Quartz).—These are at present the only largely developed and accessible properties on the Mariposa estate, and though previously referred to in our Xth Report, p. 35, they appear to merit more particular description.

Within the limits of these claims the great "Mother Lode" forks, one branch—the Josephine, or "West Lode"—striking to the northwestward, the Pine Tree, or "Mother Lode," having a somewhat more north-

erly course, and continuing with its well-marked characteristics through Mariposa and Tuolumne counties to Carson Hill, in Calaveras County,

beyond which it splits up, takes on a new aspect, and continues under different conditions.

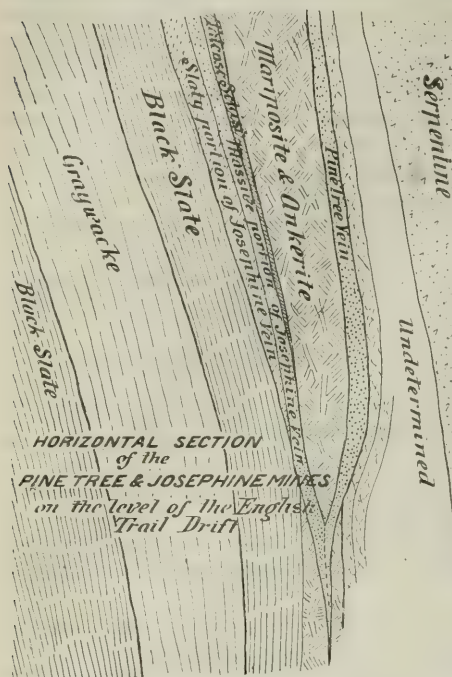
The Pine Tree vein is characterized by its massiveness and the entire absence of slaty material. Where exposed in the workings it occurs at a contact of the ankerite and a much altered massive rock, which lies to the east of it, the character of which has never been satisfactorily determined. At its point of convergence with the Josephine vein both are included within the ankerite. Northward the hanging-wall of the Pine Tree vein becomes a light-gray, coarsely granular rock, and still farther northward it is serpentine.

The Josephine, like the Pine Tree vein, has the ankerite on either side, but

northward passes out and lies at a contact of ankerite and black slate. Farther northward a long, slender, wedge-like mass of gray talcose schist lies between the vein and the ankerite, while the foot-wall is black slate. How far the gray talcose schist continues is not known, but at some distance northward the Josephine vein lies entirely within the slates.

The hanging-wall portion of the Josephine vein is usually more massive than that of the foot-wall, which is characterized by the inclusion of a large amount of slaty material, and often by a banded structure. The vein varies from 20 to more than 50 ft. in width. Cross-cuts show one ore shoot to range from 48 to 51 ft. in width for a distance of more than 200 ft. The shoot, it is believed, pitches northward. The foot-wall of the Josephine vein is not always well defined, the quartz at times becoming more and more slaty, the slate finally occurring in excess of the quartz. The limit of the shoot is determined by the amount of gold contained in the rock. As a rule, the slaty foot-wall portion is richer than the more massive quartz on the hanging-wall side.

The occurrence of *erythrite* (hydrous cobalt arsenate) in the Josephine Mine has been noted by H. W. Turner, of the United States Geological Survey, and others. The pink-colored efflorescence (cobalt bloom) of this mineral was observed by the assistant in the field of the Mining Bureau in a drift running east from the Josephine toward the Pine Tree vein. An examination of the rock on which the *erythrite* occurs (a talc



schist) resulted in the discovery that it contained the rare mineral *danaité* (*cobaltic mispickel*), a cobalt-bearing arsenical pyrite.

*Piñon Blanco Mines*.—See our Xth Report, p. 43.

*Pocket Lode*.—Is 7 miles E. of Mariposa, in a small mining camp called Mono, which is the southern limit (as far as known) of a granitic dike which extends in a southeasterly direction 15 miles from Buckthorn Mountain. In texture this dike ranges from felstone and granulite at the southern end and in its smaller branches, to a coarse-grained, mica-bearing granite of rather coarse texture northward, where it is 60 to 100 ft. wide. Its characteristics are described in our Xth Report under the caption "The Talc Mines," p. 304. Northward this belt is called the "Porphyry Mines."

*Porphyry Mines*.—See Pocket Lode.

*Potosi Mine* (Quartz).—It is on the "West Lode," 2 miles W. of Coulterville, adjoining the Malvina. See our VIIIth and Xth Reports, pp. 347 and 39. Cook Estate, of Coulterville, owner.

*Princeton Mine* (Quartz).—It is at Princeton, and belongs to the Mariposa Estate. Has been very productive, but suspended work at the 400 ft. level. In character it resembles some of the Amador County mines, near Plymouth.

*Quail Mine* (Quartz).—It is 10 miles E. of Coulterville. Provided with a mill and is worked when there is water in the gulches. F. Bruschi, of Coulterville, owner.

*Quartz Mountain Mine* (Quartz).—This is 2 miles S. of Hornitos. The vein strikes N. 30° E., dipping 28° S.E. The erosion of the hanging-wall from the upper portion of the vein has left a large exposure of quartz. The hanging-wall is chloritic schist; the foot-wall diorite schist. The main incline has reached a depth of 200 ft.; levels were run 150 and 200 ft. from the surface, and a stope opened between them. A 10-stamp prospecting mill is on the mine and is run week days only. The sulphurets are concentrated on two Frue vanners. M. L. Rogers, of Hornitos, owner.

*Red Cloud Mine* (Quartz).—It is in the slate area 10 miles N.E. of Coulterville. See our VIIIth Report, p. 345. Geologically it is very similar to the Hite Mine. In operation in 1893. Red Cloud Mining and Milling Company, of Boston, owners.

*Red Hill Mine* (Quartz).—It is near the "Mother Lode," 4 miles S.E. of Coulterville. It occurs on the contact of serpentine and diabase. The ore is gold-bearing copper sulphurets. See our Xth Report, p. 41. G. Commissiona, of Coulterville, owner.

*Sebastopol Mine* (Quartz).—It is 4 miles S.E. of Mariposa, on the Hart ranch. See our Xth Report, p. 305. The vein is accompanied by a dike of aplite (a granite without mica). This mineral belt, with its granitic dikes, extends southeasterly into Madera and Fresno counties. — Hart, of Mariposa, owner.

*Sherlock Mine* (Quartz).—It is 5½ miles N. of Mariposa. See our Xth Report, p. 306.

*Sirocco Mine* (Quartz).—This is 1½ miles W. of Bear Valley P. O., just outside the limits of the Mariposa estate. The vein is a fissure, striking E. and W. in diabase, which along the fissure is altered to chloritic schist. The gold is found in quartz, which occurs somewhat irregularly, including many lens-shaped bunches of the country rock. Some of the schist is also rich in gold. The property is equipped with a



steam hoist. Work was resumed in July, 1893, after a period of idleness. Burt & Bach, of Bear Valley P. O., owners.

*Star Mine* (Quartz).—It is 12 miles E. of Coulterville. P. P. Mast, of Springfield, Ohio, owner.

*Talc Mines*.—See Pocket Lode.

*Tyro Mine* (Quartz).—It is on the "West Lode,"  $1\frac{1}{2}$  miles S. of Coulterville. It is equipped with a steam hoist and a 10-stamp mill, all under one roof. In July, 1893, the shaft had reached a depth of 420 ft. The vein varies from 4 to 7 ft. in thickness. The quartz contains about 3 per cent of sulphurets. For geological description, see our Xth Report, p. 39. Tyro Mining Company, owners; Thos. Haven, Secretary, 110 Montgomery Street, San Francisco.

*Vanderbilt Mine* (Quartz).—This property is on the southern end of Buckingham Mountain, 8 miles E. of Mariposa, and in the mica schists, having granite both E. and W. of it. This belt extends southeastward to Potter Ridge, in Madera County. The Vanderbilt Mine comprises a number of large bunches and vein-like masses of glassy quartz associated with granitic dikes, one of which contains gold. Considerable work has been done on the property, but it was idle in 1893. The hanging-wall is granulite and the foot-wall mica slate, which, near the contact with the granitic dike, has developed crystals of feldspar of considerable size. Judge Condon, of Mariposa, Superintendent.

*Virginia (Coe) Mine* (Quartz).—It is on the "Mother Lode," 4 miles S.E. of Coulterville. See our Xth Report, p. 41. Virginia Mining Company, of Springfield, Ohio, owners; J. S. Crowell, Secretary.

*Washington Mine* (Quartz).—It is  $2\frac{1}{2}$  miles N.E. of Hornitos. Formerly a large producer, but is now idle. It is 1,500 ft. deep; strikes N.  $40^{\circ}$  W., and dips  $70^{\circ}$  S.E. The vein, 6 to 12 ft. wide, is inclosed in mica and hornblende schists. A dike rock of light color and felsitic texture accompanies the vein, occurring on the foot-wall side of the vein at the north end and on the hanging-wall side at the south end. Considerable masses of rock resembling the ankerite and mariposite of the "Mother Lode" occur in the Washington Mine. M. L. Rogers, of Hornitos, owner.

A further description of the geology of the region about Hornitos will be found in our Xth Report, p. 26. Large quantities of beautifully radiated pyrophyllite are found on a prominent butte  $2\frac{1}{2}$  miles from Indian Gulch P. O., and north of the road to Merced.

*Whitlock Mine* (Quartz).—It is 5 miles N. of Mariposa. The vein is from 4 to 10 ft. wide, and is developed by several hundred feet of tunnels and shafts. See our Xth Report, p. 33. Ward Bros., of Mariposa, owners.

*Wilson Estate Mines* (Quartz).—They are 1 mile E. of Hornitos. Miss Rose McCann, of Hornitos, owner.

#### MENDOCINO COUNTY.

The gold mining interests of this county are comparatively unimportant, very few mines being opened or worked.

*Boy Edgar Mine* (Quartz).—It is on top of the ridge and to the west of the trail from Ukiah to Lost Valley. There are five small openings made, and in every one a quartz vein is exposed. The largest one is 15 in. wide, strikes about N. of E., and stands nearly vertical. The

walls are micaceous slate. The quartz is said to assay \$4 75 in gold. C. H. Staut, of Ukiah, owner.

*Red Mountain Mining District* lies on the western slope of the high ridge which divides the waters of Russian River from those of Clear Lake and Cache Creek, and extends from Doolan Cañon about 14 miles S. The country rock consists of serpentine and highly metamorphosed slates and sandstone. Gold in small quantities has been found in the gravel and debris of the lower foothills. Veins of gold-bearing quartz and of copper are found near the summits of the range, and several prospectors are at work on them.

*Van Allen Mine* (Quartz).—It lies on the slope of the high ridge of mountains west of Ukiah. The workings consist of an incline 20 ft. deep, and a tunnel, just started, farther down the hill. The ore consists of small stringers and irregular masses of quartz, showing sulphurets. The veins have a strike of 64° S. of E., and dip 45° N. The country rock is a tough, blue glaucophane schist. Wm. Van Allen, of Ukiah, owner.

#### MONO COUNTY.

The gold deposits of Mono County are found in a number of districts, the most important of which are Bodie, Jordan, and Homer districts. As a general thing most of the gold ores carry more or less silver. At Bodie they occur in hornblende andesite, and in Homer District in granite. Most of the work in the gold mines of this county is at present confined to Bodie and the region about Lundy. There are other sections where there are deposits of prospective value lying idle.

*Basset Mine* (Quartz).—This mine is situated in the old Mono Diggings, 12 miles W. of Bodie and half a mile S. of the Columbia Mine. The vein opened here runs N.E. and S.W. and has a thickness of about a foot. It dips S.E. at a low angle. The property is developed by three drifts, 90, 30, and 40 ft. long, respectively. H. T. Trewethan, of Lundy, owner.

*Bay Queen Mine* (Quartz).—It is situated near the summit of Mount Scowdan, 3 miles S.W. of Lundy. It is developed by a shaft 120 ft. deep. The vein stands very steep and is inclosed in granite. Finley Cameron, of Bodie, owner.

*Bryant Mine* (Quartz).—It is situated in the Homer Mining District, 3 miles S. of Lundy. The vein is a continuation to the S. of that on which the May Lundy and Lakeview are situated. It is developed by an incline 147 ft. deep, and by a drift from the bottom S. 180 ft. and N. 120 ft. A drift has also been run from the surface on the southern end of the claim. The character of the ore and position of the vein is very similar to that of the mines on the north. See our VIIIth Report, p. 371. H. B. Gleaves and H. P. Morrill, of Portland, Maine, owners.

*Charleston Mines* (Quartz).—This group of mines is situated on the north side of a small cañon a little south of Mill Creek, and immediately overlooking Mono Lake. Here are eight claims, of which the *Illinois* and *Charleston* are the only ones on which much work has been done. The *Illinois* is situated on a ledge running N.E. and S.W., with nearly vertical dip. It is developed by a shaft 50 ft. deep and by a tunnel 125 ft. long. The vein is somewhat bunchy, sometimes reaching a width of 5 ft., and is free milling. The *Charleston* lies at an elevation of 8,700 ft. It is developed by a tunnel and cross-cuts amounting to about 400

ft. A heavy body of quartz in a silicious slate was met a short distance within the tunnel. An excellently appointed 5-stamp mill, run by water power, has been erected below the Illinois claim. See our VIIIth Report, p. 385. J. P. Hammond, of Mono Lake P. O., owner.

*Columbia Mine (Quartz).*—It is in Mono Diggings, 12 miles W. of Bodie. The vein runs nearly N. and S., being inclosed in granite, and is generally very flat. The greatest width is about 10 in. It is developed by two tunnels, the lower 160 ft. and the upper 125 ft. long. From the upper one the vein has been stoped to the surface. The ore is free milling and rather high grade. T. Albright, of Lundy, owner.

*Dark Horse Mine (Quartz).*—This mine is situated on the western slope of the White Mountains, 10 miles N. of Bishop Creek. The ore body has the form of a bunch or kidney instead of a vein, and consists of sugary quartz, in places white, in others deeply stained with iron oxide. The property is opened by a shaft 110 ft. deep, and by tunnels and cross-cuts having a total length of about 700 ft. As shown by the workings, the ore body descends nearly vertically, but appears to become smaller. The inclosing rock is limestone. J. H. Bulpit, of Bishop Creek, owner.

*Duarte Mine (Quartz).*—It is situated 5 miles N.E. of Laws Station, and just above the Southern Belle. Here are two claims, on each of which there is found a small vein. The lower is opened by an incline 56 ft. deep and the upper by surface work. The ore in the latter is high grade. The inclosing formation is slate. — Duarte, of Laws P. O., owner.

*Dunderberg Mine (Quartz).*—This mine is situated in the Castle Peak District, 12 miles S. of Bridgeport. Here are seven claims on one vein running south from Green Creek, and dipping at a high angle to the west. The claim on which the developments have been made lies in the middle. A cross-cut tunnel 700 ft. long has been run from the east, cutting the vein. From this tunnel drifts run N. and S., the former being 200 and the latter 150 ft. long. From these drifts considerable stoping has been done. Except near the surface the gold is contained almost wholly in iron sulphurets. The vein varies from 2 to 8 ft. wide, the ore being rather high grade. This property has recently been placed under a working bond. A mill was operated here years ago, but much difficulty was found in saving the gold. A. F. Bryant, of Bridgeport, and G. K. and B. F. Porter, of San Francisco, owners.

*Faulk Mine (Quartz).*—This mine is situated in Lake Mining District, and joins the Mammoth on the north. It is developed by three tunnels, the lower and middle said to be 1,600 ft. long, and the upper 240 ft. These tunnels open a large vein of low-grade quartz from the north end of Mineral Hill. The vein dips about 70° E. near the surface, but in the deeper workings is said to dip west. The Mammoth Mine was worked chiefly through these tunnels. The vein is said to average 12 ft. in thickness, and with the exception of rich pockets of free gold the ore is mostly iron sulphurets. D. C. Albright, of Bishop Creek, owner.

*Goleta Mine (Quartz).*—It is on the eastern base of the Sierra Nevada Mountains, 6 miles N.E. of Lundy. It is one of a series of mines on an immense ore deposit running N. and S. This has not yet been opened sufficiently to show its pitch; the eastern wall is limestone, the western a porphyry-like rock. On the eastern side of this deposit is a vein of copper ore (malachite), 6 to 20 ft. in width, and averaging 8 per cent



of metallic copper. The copper carbonate impregnates an exceedingly crushed and decomposed rock. On the west is the gold and silver vein. This is much decomposed on the surface and in most of the workings, the quartz being honeycombed and in places almost replaced by the decomposed rock-mass and iron oxides. The quartz is evidently a replacement of the rock along the mineralized zone. The deposit is opened by two tunnels. The lower one is 1,190 ft. long and has not yet cut the ore body. The upper tunnel is 359 ft. above, and has a length of 360 ft. The copper vein has been drifted on N. 156 ft. and S. 182 ft. The upper tunnel runs through the quartz vein 67 ft. without striking the western wall. A drift has been run N. 40 ft. and S. 30 ft. From the south drift a winze has been sunk 56 ft. There are two cross-cuts on the vein from the north drift, 23 and 47 ft., without reaching the western wall. From the south drift two other cross-cuts have been run, respectively 38 and 49 ft. long. In places the decomposed ore is replaced by hard quartz, carrying iron sulphurets. The value of the ore is about equally distributed between gold and silver. On the same mine to the south and 400 ft. above, a shaft has been sunk 65 ft. on the vein. At this point the vein is 24 ft. wide. This is perhaps the largest ore deposit in the county, being traceable for over 7,000 ft. See our VIIIth Report, pp. 364 to 365. Goleta Mining Company, 330 Pine Street, San Francisco, owners.

*Gorilla Mine (Quartz).*—This mine is situated on the northern slope of Mount Scowdan and west of the Wolverine. The vein runs N. and S. and dips  $80^{\circ}$  W. The property is developed by two tunnels, from which a large amount of stoping has been done. The vein is supposed to be the same as that cut in the Erie tunnel. The ore was sent down the mountain by means of a tramway 2,700 ft. long. See our VIIIth Report, p. 370. Gorilla Mill and Mining Company, of San Francisco, owners.

*Gray Eagle Mine (Quartz).*—This mine lies 1 mile S.W. of Lundy, on the northern slope of Mount Scowdan. The quartz crops quite prominently nearly the whole length of the claim, ranging from a few inches to 3 ft. in thickness. The ore is honeycombed and shows some sulphurets. Considerable galena is present. Along the croppings the ledge is almost flat. F. Pierce, of Lundy, owner.

*Harrison Mine (Quartz).*—This mine is situated 1 mile S.W. of Lundy, on the northern slope of Mount Scowdan. The elevation is a little over 9,200 ft. The mine is the eastern one of a series located on a vein which has in general an E. and W. course and dips into the mountain at a low angle,  $15^{\circ}$  to  $20^{\circ}$  S. The vein reaches a thickness in places of 20 in. The ore is reported to carry nearly equal amounts of gold and silver in places, but the gold generally predominates. The silver is found in stringers and bunches of galena. The mine is opened by several short tunnels, from which some stoping has been done. A. L. Butterfield, of Lundy, owner.

*Homer Mill and Mining Company (Quartz).*—The property of this company, consisting of three patented claims, is situated on the north-western slope of Mount Scowdan. The work done here consists of a tunnel 500 ft. long, run southerly on a bunchy vein. From the end of this tunnel one cross-cut runs W. 300 ft., and another E. 80 ft. The country rock is a dark feldspar porphyrite, in places heavily mineralized with iron sulphurets. No ore has been milled from this mine.

See our Xth Report, p. 342. Homer Mill and Mining Company, 330 Pine Street, San Francisco, owners.

*Homestake Mine.*—This property lies in Silverado Cañon, on the eastern slope of the Sweetwater range. The ore is very rich in places, carrying gold and silver in about equal amounts. But little work has been done here for some time. See our VIIIth Report, p. 360. Andy Sayers, of Bridgeport, owner.

*Jackson and Lakeview Mining Company (Quartz).*—The mines of this company are situated on the eastern slope of Mount Scowdan, at an elevation of nearly 11,000 ft. They include the *May Lundy*, *Lakeview*, and *Jackson*. The first two are located on an easterly series of veins, and the other to the west a little higher up the mountain. The May Lundy veins run N. and S. and dip at an angle of 30° to 74° W. At a vertical depth of 200 ft. the main vein has a pitch of 40°. There are three tunnels on the May Lundy Mine; the lower being 1,150, the next 600, and the upper 160 ft. long. Several winzes have been sunk below the lower tunnel, the deepest being 170 ft. On the incline of the vein this gives a depth of 750 ft. The east vein runs from 14 in. to 6 ft. in thickness. The ore is high grade. Occasionally a little galena, rich in gold, is found. In the bottom of the workings the amount of iron sulphurets has been found to increase greatly, and the free gold to decrease. The west vein on the May Lundy has not been worked. This vein is less than a foot in thickness, but rich. The *Lakeview* has been opened by a cross-cut tunnel cutting both veins. On the east vein a tunnel has been driven north connecting with the May Lundy. To the south a drift has been run 420 ft.; on the west vein drifts have been run N. 120 ft. and S. 56 ft. From this level a winze has been sunk, and the ore found to consist almost wholly of sulphurets. Above it was mostly free gold. The ore is conveyed 1,000 ft. to the mill by means of a wire tramway. See our VIIIth Report, p. 371. R. T. Pierce, of Lundy, Superintendent.

*Johnnie and Rose of the West Mines (Quartz).*—They are situated 16 miles S. of Benton. Here are found two veins running parallel and 600 ft. apart. The course is N. and S., and dip 45° W. The ore consists of free gold and sulphurets. The vein is said to average 1 ft. in thickness. John King, of Benton, owner.

*Last Chance Mine (Quartz).*—It is situated on the summit of Mount Scowdan, at an elevation of nearly 11,500 ft. Three veins are found here; two running N. and S. and dipping 70° E., and one running E. and W. and standing about vertical. The ore is free milling, and said to be high grade, particularly that of the E. and W. vein. The vein lying to the west is widest, being nearly 4 ft.; the others vary from a few inches up to 1½ ft. The veins are in granite and lie above the May Lundy series. The work done consists of three short tunnels. W. F. McKenzie, of Lundy, owner.

*Lora Mine (Quartz).*—It is in the Yellow Jacket Mining District, 10 miles S. of Benton. Here occurs an E. and W. vein, extending between the Neal and Tower mines. The ore carries lead, silver, and gold, and is said to be high grade. An incline shaft has reached a depth of 90 ft. The pay streak is from 4 to 6 in. wide.

*Lucky Mortan Mine (Quartz).*—This mine is situated nearly 3 miles S. of Lundy, and joins the May Lundy Mine on the north. Two winzes have been sunk, each 40 ft. Frank Todd, of Calais, Maine, owner.

*Mabel Mine (Quartz).*—It is situated on the western slope of the White Mountain range, 11 miles N. of Bishop Creek. On this claim are a number of deposits of irregular vein form, extending N.W. and S.E. in limestone. The ore consists of a friable sugary quartz, in places white, and in others deeply stained with iron oxides, which almost replace the quartz at times. The deposits outcrop prominently on both sides of Warm Spring Cañon, and are opened by tunnels and cross-cuts to the amount of about 400 ft. The ore is generally low grade, the deeply iron-stained portions generally being poorer than the lighter colored quartz. There are five claims in this group; three lying over the hill on the south side of the gulch, and containing silver and galena. The Excelsior claim has 400 ft. of tunnels and cross-cuts, though but little ore has been met. Owen Neylon, of Bishop Creek, owner.

*Mammoth Mine (Quartz).*—This mine, situated in Lake Mining District, was thoroughly described in our VIIIth and Xth Reports, pp. 373 and 341. Bank of California, of San Francisco, owner.

*Mineral Chief Mining Company.*—The property of this company is situated near the eastern base of the Sweetwater range, in the Patterson District. Here are four claims on a series of veins running a little E. of N. and W. of S. A great amount of movement has taken place along this fissure system, judging from the heavy clay seams and the broken condition of the ledge near the surface. The property is developed by one tunnel 750 ft., another 300 ft. long, and by a double-compartment shaft 200 ft. deep. Several veins have been cut, but so little work has been done on them that their character is not definitely known. T. C. Sharp, of Clinton, owner.

*Mono Mine (Quartz).*—It is situated on the northern slope of Mount Scowdan, on the western extension of the Gray Eagle. But little work has been done here. The characteristics of the vein and ore are similar to the Gray Eagle. See our VIIIth Report, p. 396. R. G. Montrose, of Lundy, owner.

*Monte Cristo and Headlight Mines (Quartz).*—These mines are situated in Lake Mining District, and a little south of the Mammoth. They are developed by a joint tunnel, which has been run a distance of 1,600 ft. from the west side of Mineral Hill. A vein was struck, but no ore has ever been extracted. See our VIIIth and Xth Reports, pp. 360, 371, 373, 375, and 341. Hon. P. Reddy, of San Francisco, owner.

*Montecito Mine (Quartz).*—It lies 6 miles N.E. of Lundy, and joins the Goleta on the south. On this claim two tunnels have been run, 38 and 80 ft. long, respectively, cross-cutting the vein, but without reaching the western wall. A shaft has been sunk 40 ft. The character of the ore is the same as the Goleta. D. E. Jones, of Lundy, Superintendent.

*Native Wonder and Mono Queen Claims (Quartz).*—These properties were discovered the past year and have been only slightly developed. The Native Wonder is situated on the north side of a steep cañon, west of Mono Lake, while the Mono Queen is opposite, on the south side of the cañon. The Native Wonder runs nearly E. and W., and has been opened by a short drift showing a vein 18 in. in thickness. The Mono Queen is a blanket vein, and has been opened by a tunnel 70 ft. long. The ore is honeycombed, and is said to be high grade. E. C. Mattly, of Mono Lake, owner.

*Neal Mine (Quartz).*—It is 6 miles S.W. of Benton, at an elevation of 8,000 ft. Here occurs a large vein of quartz, which, it is said, can be



traced for several miles both N. and S. The vein dips at an angle of  $70^{\circ}$  W., and shows very regular walls, the inclosing formation being granite. This mine was opened in 1878, but has been in litigation until recently. The developments consist of a tunnel 156 ft. long, and a cross-cut on the vein, where it is 27 ft. wide. From the end of the tunnel a shaft has been sunk 47 ft., with a cross-cut, toward the hanging-wall, of 17 ft. The great body of the ledge is low grade, but in the middle and on the foot- and hanging-walls there are rich seams. Along the walls the ore is much crushed and decomposed. The surface croppings are very prominent. Hon. P. Reddy, of San Francisco, owner.

*New Enterprise, Bishop, Blackrock Consolidated, Adrian, and Oro Mines* (Quartz).—These properties are situated in the town of Bodie. For a number of years they have lain idle, but a company has recently been organized by Messrs. Cain, McCone, and Kelly, of Bodie, to reopen them. See our VIIIth Report, p. 398.

*Noonday Mine* (Quartz).—This mine is situated one half mile south of Bodie. The property is at present being worked under a lease. No new developments have been made since the publication of our VIIIth Report. See our VIIIth Report, p. 396. Reese, Cameron, Kelly & Graham, of Bodie, owners.

*Ontario Syndicate* (Quartz).—The claims of this company, ten in number, are situated on the northern slope of Mount Scowdan. It is intended to develop them by means of a tunnel which has been commenced at an elevation of 400 ft. above Mill Creek. The tunnel has been run as a cross-cut for 100 ft., and from that point follows the course of a vein S.E. for 760 ft. The vein varies from a mere seam up to 6 ft. in thickness. In addition, considerable work has been done on the surface. Ontario Syndicate, of Lundy, owners.

*Parrott Mines* (Quartz).—They are situated on the N.W. slope of Mount Scowdan, at altitudes ranging from 9,000 to 9,600 ft. The veins occur in blocky argillite, feldspar-porphyry, and other hard, silicious rocks forming bold cliffs several hundred feet high. The *Grand Prize* claim lies to the west and includes several veins having a N. and S. direction, and dip to the W. The veins are generally small, sometimes reaching a width of 18 in. No underground developments have been made. The eastern claim is known as the *Bonanza*. Several veins are found on it. Enough work has been done to show that in places the ore is very rich. — Parrott, of Lundy, owner.

*Rattler Mine*.—This mine is situated on the north side of Ferris Cañon, in the Sweetwater Mountains. Here are two veins: one but slightly developed and carrying gold; the other, silver and gold. The latter runs N. and S. and dips about  $50^{\circ}$  W. This vein varies in width from a few inches to 3 ft. In many places it is high grade, the gold forming about one sixth of the value. The quartz is peculiar in showing numerous drusy cavities and in containing fluor-spar disseminated through it. The vein is opened by four tunnels, exposing it vertically for over 300 ft. The inclosing rock is a white porcelain-like porphyry. See our VIIIth Report, p. 362. Foulk, Kilpatrick & Brown, of Sweetwater P. O., Nevada, owners.

*Rattlesnake Mine* (Quartz).—It is situated in the Mono Diggings, 12 miles W. of Bodie. The country rock is granite. The vein runs N. and S. and dips at an angle of  $25^{\circ}$  W. In thickness it ranges from a mere seam up to 13 in. It has been stoped out on the incline to a depth of

133 ft. A two-compartment shaft has recently been sunk, cutting the vein at a depth of 155 ft. The ore is free milling and medium high grade. See our VIIIth Report, p. 363. M. J. Cody, of Lundy, owner.

*Sacramento Mine* (Quartz).—It is situated on the western slope of the White Mountain range, 15 miles N. of Bishop Creek. The vein occurs inclosed in granite, having an E. and W. course and northerly dip of  $20^{\circ}$  to  $30^{\circ}$ . The main portion of the ore shoot varies from  $1\frac{1}{2}$  to 4 ft. in thickness. The gold is found fairly evenly distributed and is mostly free. The mine has been worked in an irregular way for several years. It is opened by one tunnel about 250 ft. long. Higher up the hill a large amount of ore has been stoped out and one incline sunk on the vein to a depth of 300 ft. J. H. Bulpit, of Bishop Creek, owner.

*Southern Belle Mine* (Quartz).—It is situated at the western base of the White Mountains, 5 miles N.E. of Laws Station. The vein of gold-bearing quartz and limonite runs E. and W. in a magnesian slate, and dips at an angle of  $35^{\circ}$  N. The ore is generally soft and decomposed and easily milled. The pay streak varies from 8 in. to 2 ft. in width. The main tunnel is 225 ft. long. From the point of discovery an incline has been sunk on the ledge for a distance of 400 ft.; 270 ft. of this incline lies below the tunnel. The ore is raised this distance by windlass and then run in cars to the mouth of the tunnel. The ore is crushed in a 5-stamp mill, situated 1 mile N., and run by water power. Four other claims on different veins are owned by this company. O. E. Duenwig, of Laws P. O., Superintendent.

*Spartan Mine* (Quartz).—This mine lies S. of that part of the Sterling Company's mine which was formerly known as the *Detroit Copper Mine*. Two tunnels have been run to cross-cut the vein. The upper is 120 ft. long, of which 90 ft. is in mineralized vein matter. The other tunnel, 180 ft. below, has at present a length of 245 ft., and is being run through limestone. The vein matter is partly a mineralized limestone and partly a porphyry. M. R. Burus, of Lundy, owner.

*Standard Mine* (Quartz).—This mine is situated on the summit of the hill directly E. of Bodie. No new developments have been made in this mine since the publication of our VIIIth Report, in which it was carefully described. The work now going on is confined to that portion of the mine between the 300 and 500 ft. levels. An electric plant has been recently added, and is now in successful operation. (See special article on "Electrical Transmission" in this report.) The power is supplied by Green Creek, and the electricity is transmitted a distance of about  $12\frac{1}{2}$  miles. It is used at present to operate the mill only. A cyanide plant is in process of construction by the company for the purpose of working the tailings. The capacity is to be 100 tons per day. See our VIIIth Report, p. 385. Standard Consolidated Mining Company, of Bodie, owners; Thos. H. Leggett, Superintendent.

*Sterling (Detroit Copper) Mine* (Quartz).—The property of the Sterling Company lies about 6 miles N.E. of Lundy. One claim lies north of the Goleta, and on the same ore body, and the other south of the Montecito. The claim on the north has been opened by a shaft 115 ft. deep. That on the south was formerly known as the *Detroit Copper Mine*, and was described in our VIIIth Report, pp. 364 to 365. In past years a large amount of work was done on this mine in an attempt to extract copper from an E. and W. vein. Sterling Mining Company, No. 330 Pine Street, San Francisco, owners; D. E. Jones, of Lundy, Superintendent.

*Syndicate Mine* (Quartz).—This mine is situated 1 mile E. of Bodie, being the most northern of the Bodie group of mines. The mine is being worked under a lease at present. No new ore bodies have been found, and the work is confined to that left by the company. This mine, in connection with the others in the vicinity, was described in our VIIIth Report, pp. 382 to 401. See our VIIIth Report, p. 387. Parr & Tyack, of Bodie, owners.

*Wild Rose Mine* (Quartz).—This property is situated 8 miles S.E. of Benton. The vein runs N. and S. and dips W. The country rock is granite. It has been opened by a tunnel 300 ft. long, connected with the surface by a 150 ft. upraise. Below the tunnel three winzes have been sunk, 25, 36, and 125 ft., respectively. In the bottom the ore became more base, water being encountered 25 ft. below the tunnel. In the lower part of the workings silver is reported to have predominated and to be accompanied by a little galena. The ore is high grade. Where the vein has been worked it is said to be from 4 to 6 ft. wide. The mine has been abandoned for some time, but it is now the intention to open the old workings. See our VIIIth Report, p. 378. McNamara & Dowd, of Benton, owners.

*Wolverine Mine* (Quartz).—It is situated on the northern slope of Mount Scowdan, at an elevation of 9,700 ft. The vein is inclosed in granite, runs E. and W., and dips into the mountain at an angle of 25° to 30°. It is developed by an incline 70 ft. deep and by a tunnel 70 ft. long, connecting with the bottom of the incline. Some stoping has also been done. The width of the vein varies from a few inches up to 3 ft. The ore is free milling, though containing some sulphurets of iron. Lake Lundy Mill and Mining Company, of San Francisco, owners; R. G. Montrose, of Lundy, Superintendent.

#### MONTEREY COUNTY.

In this county there is only one group of gold mines. These mines are in the Los Burros District, in the Santa Lucia Mountains. These are the only gold deposits of any special value in the Coast Range south of Lake and Colusa counties. At the time of the examination of these properties by the Bureau representative, very little work was being done.

*Grizzly Mine* (Quartz).—This mine lies about three fourths of a mile to the east of the main camp of Los Burros District. The vein is inclosed in sandstone, and courses E., and dips N. It is rather bunchy, like the others in this district, due, of course, to the broken character of the country rock. The ore is high grade, running \$60 to \$100 per ton. The greatest depth reached is 160 ft. The ore is different from the other mines in the vicinity, the gold being very fine and not generally visible to the eye. Iron and arsenical pyrites and zinc-blende are also present. The vein varies from 10 in. to 4 ft. in width. See our XIth Report, p. 260. H. C. Dodge, of Mansfield, Superintendent.

*Last Chance Mine* (Quartz).—See our VIIIth, Xth, and XIth Reports, pp. 405, 580, and 260. The only work going on here at the time of our inspection in 1893 was the sinking of an incline on one of the veins. The old workings were not accessible. The inclosing rocks are sandstone interstratified with thin seams of shale, the whole so crushed that the bedding is hardly apparent.



## NEVADA COUNTY.

In all essentials for making the business of mining profitable this county is particularly favored. It has railroad facilities, water power, adequate timber supplies, good wagon roads, and in the main mining centers a most delightful climate. It has been the cradle of quartz mining and milling in this State, and it is in this county that the depression which has been hanging over the mining industry shows the first evidence of being raised. Not only are several of the enjoined hydraulic mines making preparations to resume, in part, their former activity, but numbers of quartz mines that were compelled to suspend operations under the old methods of mining have been resuscitated under the new conditions, and apparently have a long lease of prosperity in store. Foreign capital has been brought into this county during the past year, and more is preparing to come, assuring business activity for the future, and an increased gold production.

*Badger Hill Mine* (Hydraulic and Quartz).—This property is situated in Cherokee District, 1 mile S.E. of Cherokee, and work is being carried on in a quartz vein that has been uncovered in the pit, known as "The English Mine." The vein courses N. and S., dipping E., in slate bedrock, with a width of 18 in. A shaft 12 by 4 ft. has been sunk 100 ft., at which depth drifting both ways on the vein has been commenced. The hoisting plant is run by water on a 4 ft. Pelton wheel under 150 ft. pressure. The quartz is dark colored, with about 6 per cent of sulphurets and arsenical pyrites. Should the vein continue as favorable in sinking the next 100 ft. a mill will be erected on the property. Badger Hill Gold Mining Company, of North San Juan, owners.

*Baltic Mine* (Quartz).—This property is situated in Secs. 34, 35, and 27, T. 18 N., R. 11 E., God's Country Ravine, in Eureka District, 7 miles from Washington and 5 miles S. of Graniteville. The property has been idle for some time, but a patent has lately been applied for, and as soon as issued the mine will be developed. The claim consists of 4,500 by 600 ft. on the vein, which courses N.E. and dips at about 45° E. A 378 ft. tunnel has cross-cut the vein at 35 ft. perpendicular depth; this block of ground has been stope. Two pay shoots are known, 290 and 125 ft. long. The 20-stamp steam mill has a large-sized Blake crusher and roller, self-feeders. The grizzly is constructed of 1½ by 4 in. scantling, cut beveled on the long side, and covered with heavy strap iron; the bars set 1¼ in. apart. The mortars are extra wide above the dies, flaring, both in front and back, about 2 in. A back silvered plate 6 in. wide is used, and the lip of the mortar is covered with plate. The aprons are 5 by 5 ft., set on a grade 1 in. to the foot. The ore has to be hauled half a mile, at a cost of 60 cents per ton. The cost of milling by steam is \$2 per ton, requiring a 40 horsepower engine. Cordwood costs, delivered, \$2 25 per cord. The ore carries comparatively no sulphurets. See our VIIIth Report, p. 451. J. McBean et al., owners; W. H. Mead, of Washington, Superintendent.

*Belle Fontaine Mine* (Quartz).—This property is on Deer Creek, 3 miles E. of Nevada City, in Willow Valley District. The vein strikes N. 35° E., and dips W., in a granitic formation. The claim is 1,200 by 350 ft., and along the upper end several incline shafts and tunnels have been opened, exposing three or four ore bodies, pitching apparently to the south, with quartz from 4 in. to 1 ft. between walls. The quartz

carries  $1\frac{1}{2}$  per cent of sulphurets. A tunnel now being run near the lower end of the claim, 10 ft. above Deer Creek, along the hanging-wall of the vein, is 200 ft. perpendicular below the former workings, or 600 ft. on the pitch of the vein. Pay rock was encountered 230 ft. from the mouth of the tunnel, from 4 in. to 1 ft. wide. Opportunity for water power is found in the Manzanita and Snow Mountain ditches, both of which pass above the claim; timber is also plentiful. Belle Fontaine Gold Mining Company, of Nevada City, owners.

*Brunswick Consolidated Mining Company (Quartz).*—This property was described in our VIIIth, Xth, and XIth Reports, pp. 431, 381, and 274. The mine is located in Sec. 25, T. 16 N., R. 8 E., 2 miles S.E. from Grass Valley, and is working on a N.E. vein dipping to the S.E., between slate walls, with an average width of 2 ft. The quartz is of ribbon structure, with a good percentage of sulphurets (galena, zinc-blende, iron, and arsenical pyrites); as far as developed the vein appears to make in bunches or very short shoots. The mine is opened by a three-compartment, double-tracked incline shaft to a depth of 700 ft. on a  $43^{\circ}$  pitch for the first 300 ft., below which it straightens up to  $80^{\circ}$ . The last hundred feet of the shaft is narrowed down from 14 by 6 to 10 by 6 ft. in the clear. It is timbered throughout with sawed timbers and close planked. The mine is wet, requiring an 8 in. Cornish pump running six strokes per minute in summer and ten strokes in winter. The present workings consist in drifting west on the 700 ft. level and carrying an upraise to the 600 ft. level near a bunch of good-looking ore. Brunswick Consolidated Mining Company, of San Francisco, owners.

*Cedar Mine (Quartz).*—This property is in Bear River District, 14 miles from Grass Valley, in Secs. 20 and 29, T. 14 N., R. 8 E. The croppings of the vein can be followed for 4,600 ft. on its course N.E. across Wolf Creek. The vein dips W. between slate and diabase walls; to the east, in close proximity, runs a serpentine belt. Near the banks of Wolf Creek a 40 ft. shaft has been sunk and drifts run, disclosing a 23 ft. vein. The quartz carries a large percentage of copper sulphides, oxides, and native copper, with the gold. Numerous surface prospect-holes have been made along the croppings. J. R. Nickerson, of Auburn, Placer County, owner.

*Centennial Gold Mine (Quartz).*—This property was described in our XIth Report, p. 280. It is the south extension of the Osborne Hill vein, and claims 2,200 ft. on the ledge. The mine is now under bond; a new steam hoisting and pumping plant is being erected, and as soon as the water is pumped out a crew will be set to work. The vein has a N. and S. course, in syenite walls, pitches to the W., and is not very wide. H. Sylvester, of Grass Valley, owner.

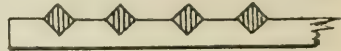
*Central Gravel Mining Company (Drift).*—This property is on the Washington Ridge, 10 miles E. of Nevada City. A bedrock tunnel has been run on a S.E. course into the ridge, from the Deer Creek side, a distance of 900 ft., where the course is changed to the N., the expectation being that about 30 ft. farther it will tap the channel coming down the ridge. The tunnel has been run through slate at a cost of \$4 50 per ft. The gravel is free, carrying washed gold worth \$17 40 per ounce. The company have free water; more can be had by buying water from the South Yuba Ditch Company, and with 300 ft. pressure. They use 25 boxes (12 ft. long) set on a 4 in. grade per box, and supplied with slat

and Hungarian riffles. Central Gravel Mining Company, of Sacramento, owners.

*Central North Star Gold Mine* (Quartz).—This property was described in our XIth Report, p. 277, and is situated in T. 15 N., R. 8 E., 3 miles S. of Grass Valley. There are three veins in the claim. The main works are on what is supposed to be the extension of the North Star vein, in diabase, with an average width of 2 ft., coursing E. and W., and dipping at an angle of  $52^{\circ}$  N. There are two shafts, about 400 ft. apart, one vertical and the other an incline ( $52^{\circ}$ ). A drain tunnel 400 ft. long carries off the surface waters. At the incline shaft a steam hoist and a 6 in. bucket pump, to make six strokes per minute, are being erected. Jas. Bennallack, of Grass Valley, Superintendent.

*Central Pacific Mine* (Quartz).—This property is situated three fourths of a mile S.W. from Rough and Ready. The claim comprises 1,500 by 600 ft., and carries a vertical vein, coursing N.  $10^{\circ}$  E., from 6 in. to 1 ft. wide, between syenite walls. Moody & Gayety, of Gold Run, Placer County, owners.

*Champion Mine* (Quartz).—This property has been fully described in our VIIIth, Xth, and XIth Reports, pp. 420, 386 and 286. The mine is located in Secs. 11 and 12, T. 16 N., R. 8 E. Since issuing our XIth Report, the shaft has been sunk to the 1,200 ft. level, and new substantial hoisting and compressor plants put in place, enabling the workings to be carried to



GRIZZLY AT CHAMPION MINE.

a depth of 3,600 ft. The capacity of the mill has been increased by the addition of 10 stamps. New grizzlies have been placed, with the bars set on edge. The stamps make 100 drops of 6 in., and have a 7 in. discharge through a No. 4 sheet-tin perforated screen, which lasts three weeks. The steel shoes last 100 days, with an average duty of  $2\frac{3}{4}$  tons per twenty-four hours. The guides are of the best white oak; the sequence of the stamps is 1, 5, 2, 4, 3, feeding from No. 3. The sides of the mortars are supplied with linings and the front has an 8 in. silver plate. Two thirds of the amalgam is retained in the battery. The aprons, 14 ft. long, are set on a grade of  $1\frac{3}{4}$  in. to the foot. The apron is scraped every other day, but the whole apron is dressed daily. The battery and battery-plate are cleaned up once a month. Between the battery-apron and the apron proper is a distributing box and quicksilver trap with an inclined bottom, in which any loosened amalgam is retained, while permitting the pulp to pass through onto the lower apron. The accumulated quicksilver is drawn off at the lowest point without stopping the battery. The rock carries 6 per cent of sulphurets, which are gathered from six single and one double Frue concentrator. These are worked in the company's chlorination works, which are arranged for saving gold, silver, and copper. About 110 men are employed, 86 underground. Champion Mining Company, of San Francisco, owners.

*Conlon Gold Mining Company* (Quartz).—This property is on Osborne Hill,  $2\frac{1}{2}$  miles S.E. from Grass Valley, and about 500 yds. W. of, and parallel with, the Osborne Hill Mine. The vein courses nearly N. and S., dipping  $42^{\circ}$  W., and carrying an average width of 26 in., with syenite wall rocks. The mine is being operated partly through an incline shaft, 9 by 5 ft. in the clear, with double compartments, 190 ft. deep, or 105 ft. perpendicular. A second opening is through a tunnel 237 ft.



long, which cuts the vein at a vertical depth of 50 ft. Two levels are being started from bottom of incline. Two air shafts connect with the tunnel, and the incline is ventilated by a blower using 4 in. air pipes. There are two shoots of ore pitching S.W. The timbering is done with sawed spruce, costing \$19 per thousand. An 8 in. bucket pump keeps the mine free from water. A 10-stamp mill, under the same roof with the hoist, contains a Hercules rockbreaker, Hendy self-feeders, 750 lb. stamps dropping 6 in. 90 times a minute, and supplied with iron shoes and steel dies costing 6 and 11 cents per pound. The stamps crush 2 tons each per day through No. 35 brass wire screens; all the water being applied on the inside of the battery. The plates consist of one inside the battery, one on the lip of the mortar; the battery apron plate, 1 ft. wide, set on a  $1\frac{1}{2}$  in. grade; a second apron plate 5 ft. long with a grade of  $1\frac{3}{4}$  in. to the foot, and a third apron plate 1 ft. narrower, set on a 2 in. grade; between each of the aprons is a distributor with  $\frac{1}{2}$  in. holes. The proportion of the amalgam saved in the batteries is given as 20 per cent, which is accounted for by the narrow mortars. The power is furnished by a 25 horse-power engine for the mill and pump, and a 15 horse-power for hoist and fan, together consuming 3 cords of wood daily, at a cost of \$3 50 per cord. Fifteen men are employed, at an average of \$3 per day. Conlon Gold Mining Company, of Grass Valley, owners.

*Culbertson Gold Mine (Quartz).*—This property is situated in the Eureka District, 2 miles from Graniteville; it is a prospect started on the extension of the National Mine. A tunnel has been started and buildings are being erected. D. J. Moore, of Graniteville, owner.

*Delhi Mine (Quartz).*—This property has been described in our VIIIth and XIth Reports, pp. 444 and 305. Since then the mine has been idle, as the expense of handling the 65 miner's inches of water that the mine makes has become too expensive. Delhi Mining Company, of North Columbia, owners.

*Derbec Blue Gravel Mining Company (Drift).*—See our VIIIth and XIth Reports, pp. 456 and 311. It comprises 647 acres. At present the company is working on the back channel, which shows a width of 75 ft. at the point of present operation; 45 men are employed. Theodore Wetzel, of North Bloomfield, Superintendent.

*Diamond Creek Consolidated (Eagle Bird) Gold and Silver Mining Company (Quartz).*—See our VIth, VIIIth, and Xth Reports, pp. 51, 440, and 389. It is in Washington District, in the Yuba Cañon, 28 miles E. of Nevada City. The several locations extend from the Yuba River to beyond the summit of the ridge toward Bear Valley. A peculiarity of this ledge is the intrusion of a dike into the vein, and on the pitch of the ore shoot, without any apparent faulting. The ore extracted at present comes from between the 400 and 600 ft. levels; about 40 tons is the daily yield. Forty-five men are employed, 30 underground. Diamond Creek Gold and Silver Mining Company, of San Francisco, owners.

*Diamond Mining and Development Company (Quartz).*—This property is on the Leeman ranch, 2 miles E. of S. from Grass Valley. The claim comprises 1,500 by 600 ft., with a N. and S. vein dipping about 30° E. The shaft, 4 by 8 ft., is 130 ft. perpendicular; at the bottom a drift has been driven 45 ft., and some stoping done. The wall rocks are syenite, and show near the vein a certain degree of stratification. Little timbering is required and not much blasting. A Cornish pump, with 5 ft.

stroke, runs six hours out of twenty-four. The hoisting and pumping are done with a small temporary steam plant. The quartz carries a fair percentage of sulphurets, mostly near the foot-walls, and for the present is crushed in a custom mill. Diamond Mining and Development Company, of Sacramento, owners.

*Eagle Bird Mine* (Quartz).—See Diamond Creek Consolidated.

*Empire Gold Mine* (Quartz).—See our VIIIth, Xth, and XIth Reports, pp. 46, 426, 371, and 272. The mine has been worked continuously for thirty-five years, and has produced over \$5,000,000. At present it employs 80 men. G. Starr, of Grass Valley, Superintendent.

*English Mine* (Quartz).—See Badger Hill.

*Ethel Mine* (Quartz).—It is in Sec. 34, T. 18 N., R. 11 E., in Eureka District, and is a prospect. Location is 1,500 by 600 ft. on a vein about 4 ft. wide in granite, running parallel to the Baltic, with a N. and S. course. An incline shaft has been sunk on the vein 40 ft. M. H. Meade, of Washington, owner.

*Federal Loan Mining Company* (Quartz).—This property was described in our XIth Report, p. 290. Since then the shaft has been sunk from the 400 to the 600 ft. level on the pitch of the vein, and 500 ft. of a drift has been run E. at the 400 ft. level, and 100 ft. in length has been stoped. The ore shoot pitches E. A crossing makes into the ledge in the 300 ft. level W. and follows the vein down without faulting; crossing the incline and continuing to the E. it appears to affect favorably the mineralization of the shoot to the E. of it, the same widening rapidly as it goes down. In the bottom of the shaft where a station is being started, the vein shows 4 ft. wide, highly mineralized. On the 400 ft. level E. a heavy stream of water enters the drift under pressure, and a second heavy stream issues from the bottom of the shaft. It requires a 10 in. plunger pump, one of 8 in., two 6 in. bucket pumps, and a 4 in. pump, to keep the mine clear of water. The ground stands well with little timbering. The sinking of the shaft below the 400 ft. level has cost \$15 a foot. Vincent & Brand, of Nevada City, owners.

*Filibuster Mine* (Drift).—See Lupine.

*Gambirinus Mine* (Quartz).—This property is in Eureka District, on Mill Ravine, 5 miles from Washington. It comprises a full claim of 1,500 by 600 ft., and is patented; also 25 acres for a mill site. The vein runs N. and S., between slate and granite, with an almost vertical dip, and has an average width of 4 ft. A tunnel starting from Mill Ravine, 650 ft. long, cross-cuts the vein 130 ft. below the surface. Former workings were carried down 80 ft. from the surface on the vein. A 5-stamp mill, run by water power, is to be moved to the mouth of the tunnel. See our VIIIth Report, p. 451. J. McBean et al., of Washington, owners.

*Gold Flat (Potosi) Mining Company* (Quartz).—This property is situated in Secs. 24 and 13, T. 16 N., R. 8 E.,  $2\frac{1}{2}$  miles N. from Grass Valley and one fourth of a mile from Town Talk. The vein courses N.  $10^{\circ}$  E., dipping  $45^{\circ}$  E.; the vein is in slate, but near the contact of the same with the granite on the north. The average width is from 18 in. to 2 ft. A double-compartment shaft, 9 by 5 ft., has been sunk on an incline of  $45^{\circ}$  to the depth of 300 ft. At 212 ft. a level has been run S. about 830 ft. under the old Potosi shaft, cutting three pay shoots; the one nearest the shaft is 75 ft. long, the second 150 ft., and the third undetermined; at present it shows 200 ft. of pay ore. Along this course

several crossings from E. to W. cut through and throw the vein to some extent. At a depth of 60 ft. from the surface the old drain tunnel of the Potosi cuts the shaft, but as it is caved it no longer answers its purpose. The walls are solid, requiring little timbering. A 10 in. Cornish plunger pump with an 11 in. water pipe makes five strokes per minute; this and the hoist are worked by a 4 and a 6 ft. Pelton wheel; the latter, with 330 ft. pressure, runs the pump. Gold Flat Mining Company, of Grass Valley, owners.

*Gold Hill (Nevada City) Mining Company (Quartz).*—See our VIth, VIIIth, and XIth Reports, pp. 49, 418, and 288. It is situated in Sec. 11, T. 16 N., R. 8 E.,  $1\frac{1}{2}$  miles W. of Nevada City. The mine is still working above the drain tunnel, and is employing 38 men. A new hoist and mill are in contemplation. Gold Hill Mining Company, of New York, owners.

*Grant and Canada Hill Mining Company (Quartz).*—This property is in Sec. 17, T. 16 N., R. 9 E.,  $1\frac{3}{4}$  miles from Nevada City, and is being operated under bond at present. They are working on the extension of the Grant vein. The main Canada Hill is filled with water. A shaft is being sunk to the south on the Grant vein, which runs through the Canada ground. W. Veal, of Nevada City, lessee.

*Harmony Gold Gravel Mining Company (Drift).*—See our XIth Report, p. 298. It is  $2\frac{1}{2}$  miles N.E. from Nevada City. The property includes 280 acres, with 3,000 ft. along the course of the channel, and is opened through an incline shaft 340 ft. long on a  $32^\circ$  pitch, from whence a tunnel turns up the channel 1,800 ft. The main channel is 150 ft. wide, largely quartz gravel. The bedrock tunnel is in swelling granite. Twenty-five men are employed on two shifts, taking out 20 carloads of gravel of 1,500 lbs. weight per day. Since our last report a 10-stamp mill has been built and all the gravel passes through the mill. The power for the same is obtained from the Snow Mountain ditch, 30 in. of water being applied to a 4 ft. Pelton wheel, at a cost of 18 cents per inch. Harmony Gold Gravel Mining Company, of Nevada City, owners.

*Hartery Consolidated Gold Mining Company (Quartz).*—This property was discussed in our Xth and XIth Reports, pp. 378 and 283. It is on Wolf Creek,  $2\frac{1}{2}$  miles S.E. of Grass Valley. Hartery Consolidated Gold Mining Company, of Grass Valley, owners.

*Home Gold Mine (Quartz).*—This is a new undertaking, located  $1\frac{1}{2}$  miles W. of Nevada City, on Deer Creek, adjoining the Providence Mine on the west. Peck's Ravine, on the west of the Providence Mine, plainly marks the contact between the granite and the diabase, and the Home company have commenced to develop a quartz ledge that crosses Deer Creek at this point, where, in an early day, some rich rock was taken out. — Moore, of Nevada City, Superintendent.

*Idaho Mine (Quartz).*—See Maryland.

*Jack Rabbit Mill and Mining Company's Mine (Quartz).*—The property was mentioned in our XIth Report, p. 278. Since then the incline shaft has been carried down to 270 ft., and two levels have been run below the drain tunnel, 75 ft. apart, and about 125 ft. long. The croppings indicate two veins, of which the one where the shaft has been sunk appears to be a west feeder to the main fissure, necessitating a cross-cut of at least 130 ft. to reach the main vein. No large ore shoots have as yet been developed, but active prospecting is being carried on. Jack Rabbit Mill and Mining Company, of San Francisco, owners.



*Knickerbocker Gravel Mine* (Drift).—This property is on Cement Hill, in Secs. 1 and 2, T. 16 N., R. 8 E., 1 mile N.W. from Nevada City, and appears to contain a part of the old river channel that comes from Sugarloaf Hill. The workings consist of a tunnel starting N.E., partly in the cement, carried so narrow and deviating so often from the original course, that, though 1,200 ft. in length, nothing definite is known about the channel sought for. It is said to be still 300 ft. to the north. Large, hard granite bowlders are frequently encountered on the bedrock, and in places pay gravel has been found in small bunches carrying coarse gold. Two men make 3 ft. per day drifting, taking out 4 tons of gravel besides. The gold is worth \$17 per ounce. No timbering is done in the mine. L. D. Craig et al., of San Francisco, owners.

*Live Oak Mine* (Drift).—See Odin.

*Live Oak and Minuet Mine* (Quartz).—This property is on Grizzly Ridge,  $2\frac{1}{2}$  miles N. from Columbia Hill, and three fourths of a mile W. of Delhi. The vein runs N. and S., dipping about  $75^{\circ}$  E., and varies in width from 2 to 12 ft., between slate walls. The developments consist of several tunnels driven on the vein from the river side. The uppermost one is 125 ft. long; 112 ft. below is No. 2, 212 ft. long; and again 66 ft. lower, No. 3 has been driven 140 ft., giving a perpendicular depth on the vein of 450 ft. The lowest tunnel, No. 4, 80 ft. long, is 200 ft. farther down the hill, and is intended for the main working tunnel, being in the vicinity of an eligible mill site. One pay shoot, pitching north, has been developed. The quartz carries from  $1\frac{1}{2}$  to 2 per cent of iron pyrites, galena, and arsenical pyrites. Little timbering is required, and no water to speak of has been encountered. Water power under 500 ft. pressure is obtained by extending the Delhi ditch. McMahon & Jennings, of Columbia Hill, owners.

*Lupine Gravel Mine* (Drift).—It is on Washington Ridge, in Sec. 21, T. 16 N., R. 9 E., in Nevada City District. The present developments indicate that the gravel cut into is from an ancient ravine that leads to the main channel under the ridge. The gravel is angular, while the gold found with it is rounded, washed gold. A high rim rock on the flank of the mountain close to the Lupine tunnel, and pitching into the hill, and a second rim rock traced near the top of the ridge, indicate the course of the main channel. There are two claims, the Filibuster and the Lupine, making a total area of 320 acres. The developments consist of a 94 ft. perpendicular shaft, and below this is a bedrock tunnel in slate running N. toward the shaft, 254 ft. long. An upraise of 14 ft. cuts into ravine wash carrying washed gold. The course of this ravine is  $S. 10^{\circ} E.$  A cut is being made diagonally across the wash to decide its width and depth. The elevation at the tunnel mouth by aneroid is 3,715 ft., and on the bedrock above the upraise 3,735 ft. That part of the ground included in the Filibuster has been hydraulicked partly. Judge Caldwell et al., of Nevada City, owners.

*Manzanita Gravel Mining Company* (Drift).—See our VIIIth and XIth Reports, pp. 458 and 302. It is situated half a mile N. of Nevada City, and comprises 160 acres. Two years ago it was started as a drift mine, having previously been hydraulicked. The incline shaft has, at the mouth, an elevation of 2,680 ft., and in its length of 260 ft. falls 56 ft. The tunnel running N. from the bottom of the shaft is 1,250 ft. long, and cuts into the channel about 3 ft. above the lowest part of the trough. The breast of the drift, which is still being driven ahead, is in

pipe-clay, and is closely lagged. The output per hour at present is 8 carloads of 27 cu. ft. each. The gravel drifts are timbered with 4 ft. posts and 6 ft. caps, and closely lagged, as a layer of sand forms part of the roof. The gravel is all small, no rock weighing over 10 lbs. being met with, and is nearly 2 ft. deep. The washing is done through 300 ft. of sluices 2 ft. wide, furnished with slat and Hungarian riffles; the first 80 ft. is cleaned up every week, the remainder once a month. The company own a water-right on Deer Creek, and conduct the water from near Scott's Flat through 7 miles of ditch. The gold is fine and sells for \$17 50 per ounce. Manzanita Gravel Mining Company, of Nevada City, owners.

*Maryland and Idaho Gold Mine (Quartz).*—The Idaho Mine was described in our VIth, VIIIth, and XIth Reports, pp. 45, 425, 372, and 271; it is situated  $1\frac{1}{2}$  miles E. of Grass Valley. These properties, formerly separate mines, have now been brought under one management by purchase. The present workings are being carried on between No. 13 and No. 15 levels at the east end of the Idaho, and extending into the Maryland ground; this depth very nearly approaches sea-level. Only half of the stamps and concentrators were working. The aprons are scraped every day and the batteries are cleaned twice a month. The amalgam saved in the batteries is 66 per cent. The mine is ventilated through an air shaft in the Maryland ground, which is connected through chutes with the back end of No. 15 level, in the Idaho, and through which an exhaust fan 10 ft. in diameter draws the foul air, making the main working shaft a down-cast. Employés number 110; of these, 80 work underground. S. P. Dorsey, of Grass Valley, owner.

*Mayflower Mine (Quartz).*—See our VIIIth and XIth Reports, pp. 453 and 295. The property lies on the contact of granite and slate, where it changes from an easterly to a northwesterly course. Six ledges are included in the location, two N. and S. and four E. and W.; the two former with a dip of  $45^{\circ}$  E., the four latter with a dip varying from  $20^{\circ}$  to  $70^{\circ}$  S. With one exception all the veins are incased in slate walls. The Grant vein has both granite and slate walls. The property contains, besides the quartz veins, a considerable body of gravel that was worked under the hydraulic system; arrangements are now being made to drift on part of it. The different veins are designated as the Mayflower, Butterfly, Beckman, North Star, Big Blue, Floyd, and the Grant. They are opened up by tunnels: No. 1 being 1,700 ft.; No. 2, 400 ft.; No. 3, 1,000 ft.; and No. 4, 700 ft. long. These last two tunnels are on the Mayflower vein. The greatest perpendicular depth attained in the mine is not over 75 ft., but on the dip of the vein the depth is 250 ft. The greatest amount of development is on the Beckman vein, which lies very flat and follows the foldings of the slate; it carries a high grade of quartz, with a good percentage of sulphurets. The ore is reduced in a 4-stamp water-power mill; weight of stamps, 950 lbs.; these drop 95 times a minute, with 6 in. drop and 4 in. discharge, through No. 6 round-punched screens, crushing  $1\frac{3}{4}$  tons to the stamp. The pulp passes over two aprons, the upper one  $3\frac{1}{2}$  by 4 ft., the second  $3\frac{1}{2}$  by 9 ft., and then from a distributor to a shaking-table, with side shake, and this yields a larger amount of amalgam than the second plate. The aprons are given a pitch of  $1\frac{1}{4}$  in. per foot, the shaking-table  $\frac{1}{4}$  in. per foot. From the shaking-table the pulp passes over Frue and Triumph concentrators. The quartz carries  $2\frac{1}{2}$  per cent of sulphurets. The plates

are scraped every day, and the battery cleaned up once a month. The power is derived from several Pelton wheels: an 8 ft. for the mill, a 2½ ft. for the crusher, an 8 in. for the concentrators, and a 5 ft. for the hoist, requiring 30 in. of water in all. Martin Bros., of Nevada City, owners.

*Merrimac Gold Mine* (Quartz).—This property was described in our XIth Report, p. 279, and lies in T. 10 N., R. 8 E., 2 miles N.E. of Grass Valley. Developments have been resumed under favorable auspices. Merrimac Gold Mining Company, owners; L. P. Goldstone, Superintendent.

*Mistletoe Mine* (Quartz).—This property is in the Rough and Ready District, three fourths of a mile S.W. from the town. It comprises 1,500 by 600 ft. The vein courses N. 50° E. and dips about 70° N.W., showing a width from 4 to 18 in. between hard syenite walls. An incline has been sunk on the vein 40 ft. The quartz carries about 3 per cent of sulphurets (iron and copper); it is hand-sorted, and the heavily sulphuretted portion sacked and shipped. The country around is poorly supplied with wood. C. J. Kent et al., of Rough and Ready, owners.

*Monarch Claim* (Quartz).—This prospect is three fourths of a mile from Rough and Ready. It comprises 1,500 by 600 ft. The vein courses N. 28° E., stands nearly vertical in syenite, and is about 4 ft. wide. A shaft has been sunk 53 ft., and is to be continued. Gayety Bros., of Gold Run, Placer County, owners.

*Mount George Gold Mine* (Quartz).—It is on Rush Creek, 3 miles from Nevada City, and controls 4,500 by 600 ft., to the west of the main granite and slate contact. The altitude of the mine is 2,300 ft. The main vein courses slightly N. of E. and dips about 62° S. The country rock is diorite, with partial slate casing along the vein. The vein shows 16 in. wide near the surface, but at a depth of 55 ft. (which is the depth of the incline shaft) it is several feet in width. The quartz carries a small percentage of sulphurets and is of low grade. North of the main vein about 25 ft. is a small ferruginous quartz seam with a course of N. 60° E. and pitching very flat, which makes into the main vein to the west. It is extremely rich in free gold, yielding at the rate of several hundred dollars to the ton, and is worked up in the hand mortar. Still farther north is another seam about 18 in. wide, and carrying a good grade of ore with copper sulphurets. Two shafts have been sunk, about 50 ft. apart, one on the main vein, the other on the feeder. The latter shaft is an incline 85 ft. deep; at 42 ft. a level turns 40 ft. on the seam. The shaft on the main vein is 55 ft. deep; a drift has been started at 40 ft. toward the other shaft, and in the bottom they have drifted 96 ft. on the main vein. A small prospecting plant, consisting of a 4 in. Cornish pump with 3 ft. stroke, making seven strokes per minute, and a hoist, are run by a 3½ ft. Pelton wheel and a 2½ ft. Knight wheel, working under 70 ft. pressure and using 12 in. of water. Timber is plentiful on the ground. J. E. Carter, of Grass Valley, Superintendent.

*Mountaineer Gold Mine* (Quartz).—This property, 1 mile W. of Nevada City, was described in our Xth and XIth Reports, pp. 384 and 287. South of Deer Creek the ore is low grade, and any ore below \$7 is not worth handling, the vein being only 12 in. wide, and the wall rock extremely hard. The quartz is a ribbon rock, carrying an average of 2½ per cent of sulphurets. The mine has been a dividend-producer for



years. Forty-five men are employed. W. A. Dennis, of Nevada City, Superintendent.

*Muller & Walling Claim (Quartz).*—This prospect was mentioned in our XIth Report, p. 296. Two veins cross the claims, supposed to be the extensions of the Champion and Wyoming. On the latter an incline at the east end of the claim has been sunk 87 ft., using an overshot wheel for hoisting. At the west end a tunnel is being driven to strike this same vein; at present it is 120 ft. long. A good deal of surface work has been done, demonstrating the presence of a large body of quartz of a good paying grade. Muller & Walling, of Nevada City, owners.

*National Gold Mining Company (Quartz).*—This property,  $1\frac{1}{2}$  miles S.E. from Graniteville, was described in our XIth Report, p. 309, and comprises 2,000 by 600 ft. The vein courses N. and S., and dips about  $75^\circ$  E. between black slate walls, about a mile W. of the granite contact, with an average width of 6 ft. Three tunnels have been driven on the upper portion of the veins, of which No. 3 runs entirely through the ridge 368 ft. below the surface; at 123 ft. it cross-cuts the vein, which it follows for 400 ft. Near the mouth of the tunnel an incline shaft has been sunk 108 ft. and a drift turned S. 200 ft. on the pay shoot, the end of which has not been reached. Stopping 150 ft. in length and 32 ft. high has been carried on here. The lower workings are connected with the tunnel by an air shaft. The foot-wall of the vein is swelling ground and shows an 8 in. gouge. The quartz is ribboned and shows free gold on the face planes, and carries about 1 per cent of sulphurets (iron and galena) and occasionally tellurides. The mine makes about 2 in. of water, which is raised by an ejector 100 ft. on the incline, through a 4 in. discharge pipe with  $\frac{3}{8}$  and  $\frac{7}{16}$  in. nozzles. Timber costs  $1\frac{1}{2}$  cents for lagging,  $2\frac{1}{2}$  cents per running foot for split timbers, and \$22 per thousand for lumber. Water power is derived from the Eureka ditch, using 15 in. under 200 ft. pressure, distributed on the following Pelton wheels: an 18 in. for the hoist, an 8 ft. for the mill, a  $2\frac{1}{2}$  ft. for the rock-breaker, and an 18 in. for the concentrators. The reduction works consist of a 5 ft. Huntington roller mill with grizzlies, Gates crusher No. 1, and Hendy self-feeder. Three aprons are placed below the mill, each 4 by 4 ft., with a  $\frac{3}{4}$  in. grade to the foot. Two Frue concentrators handle the sulphurets. The mill crushes from 17 to 22 tons per day, using No. 6 slot-cut screens, which last three days. The quicksilver groove in the mill is drawn off once a day, and plates scraped daily and dressed with sodium amalgam; the entire mill is cleaned once a month. The yield from the battery equals the yield from the plates. Fifteen men are employed, miners receiving \$2 per day and board, and mill men \$2 50 and board. Estate of D. R. Killigan, North Bloomfield, owners.

*Nebraska Mine (Drift).*—See Odin.

*Nevada City Mine (Quartz).*—See Gold Hill.

*Normandy Mine (Quartz).*—This property is in Secs. 31 and 32, T. 16 N., R. 8 E., in Dead Man's Flat, 4 miles S.W. of Grass Valley. It is only a "prospect," and the vein is about 12 in. wide and is "pockety." Said to have produced a large sum. Senechal & Richard, of Grass Valley, owners.

*North Banner Consolidated Tunnel Company (Quartz).*—This property was described in our VIIIth Report, p. 420, and now comprises five claims. Since reported on, the mill has been moved near the mouth of the lower or drain tunnel, designated as the Woodville tunnel, and five

stamps added. The mine is being worked by eleven tributors. At different times the mine has been operated through four tunnels. The main working tunnels at present are the Woodville, on a level with the mill, also used as a drain tunnel, and the Dunnigan tunnel, 170 ft. above; all of the tunnels are connected. Below the Woodville tunnel a shaft has been sunk 500 ft., with a station for hoist and pumping plant placed at the mouth, and a drift turned south from the bottom of the shaft 400 ft. in good paying ore. The general course of the quartz veins is N. 38° W., with a dip varying from 30° to 45° E., and an average width of 2 ft.; they lie along the contact of the slate and syenite, the latter forming the hanging-wall. At present no work is being done below the Woodville level. North Banner Consolidated Company, of Grass Valley, owners.

*North Bloomfield Gravel Mine* (Hydraulic).—This property was described in our VIIIth Report, p. 454, and illustrated in our IXth Report, pp. 122 and 133. At present 40 men are working on a limited area, having complied with the requirements of the law as to impounding debris, it being elevated 60 ft. and deposited in a portion of the old hydraulic pit and retained therein by means of brush dams until the slimes have settled, when the water is passed through a shaft into the main outlet tunnel and dropped into the river.

At present one monitor with a 6 in. nozzle, taking water under 500 ft. pressure, is operating on a bank over 300 ft. high, with 140 ft. of solid gravel next to the slate bedrock. At the point of operation the bedrock was pitching away, showing the presence of either a deeper basin or another channel behind.

About 1,500 ft. of 5 ft. sluices, lined with 13 in. pine blocks, costing 11 cents per foot, board measurement, are used in washing the gravel. After passing through the sluices the waste material drops into an open elevator box, up which it is thrust by the water issuing from two 4½ in. nozzles under a pressure of 500 ft. The bottom is lined with 3 in. plates of manganese steel, costing 8 cents per pound, which has been found to withstand the friction of the rocks far better than the white iron plates formerly used for the purpose. The "giant" works during the night shift; the day shift pick the ground and break up the pipe-clay and gravel.

A deep cut in the bedrock is being carried up to the face of the present bank to enable the bottoming of the deeper portion of the channel. The normal output, when everything is working to full capacity, is 2 cu. yds. per miner's inch, but under the present restricted working the output is limited by the space available for the depositing of the debris. A clean-up is made twice a month. The gold is worth about \$18 per ounce. North Bloomfield Gravel Company, of San Francisco, owners.

*North Star Mine* (Quartz).—See our VIth, VIIIth, Xth, and XIth Reports, pp. 44, 428, 376, and 270. It is one of the most important mining properties of the county.

The shaft in 1893 was 2,800 ft. deep on the incline, and the workings nearly half a mile from the collar of the shaft. There are 125 men employed, 115 of them underground.

The mill and its methods may be regarded as one of the best and most representative of the California milling process. From the entrance of the ore into the mill everything is worked by gravitation,

and the use of a shovel is rarely required. After passing over the grizzlies, which have their bars  $2\frac{1}{4}$  in. apart, the fine material drops immediately into the ore-bins that supply the Hendy Challenge self-feeders, while the coarse rock falls into a bin that discharges through a chute into the Risdon rockbreaker, which itself discharges into the main ore-bin that leads to the feeders. The feeding of the battery is performed from the center stamp, the drops being so arranged that the pulp is forced from center to outside, and vice versa.

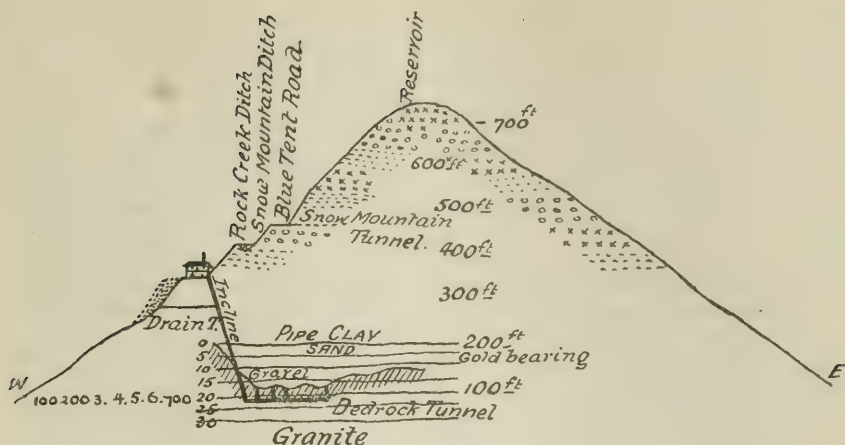
There are 40 stamps in the mill, weighing 850 lbs. each, dropping 86 times per minute, with a 7 in. drop and a 4 in. discharge. Steel shoes and iron dies are used, with an average life of 300 tons per stamp. The screens used are No. 10 perforated tin (English plate), costing 10 cents a plate, or 50 cents per screen, and last four weeks. The oak guides are long-lived, the upper set being co-existent with the mill. Plates are used in the battery. The duty per twenty-four hours is from  $1\frac{3}{4}$  to 2 tons per stamp. The apron plates are divided into an upper apron of 18 in., followed by a second of 4 ft., having between them a narrow box with a perforated screen somewhat coarser than the battery screen. The batteries and concentrators use 15 in. of water. The aprons below them have a grade of  $\frac{5}{8}$  in. to the foot, and set to the same grade are 10 ft. of sluice plates. On six of the batteries these have a width of 30 in., while on the other two they have the same width as the apron plates; the latter give the better yield. The plates are scraped and dressed every morning. Beyond these plates the pulp is led onto a shaking-table 12 ft. long, formed of a silvered plate supplied with end motion, without jar, from an eccentric working underneath. The pulp is next passed through a trap to the concentrators (12 Triumph and 4 Frue), producing about one ton of sulphurets per shift; these are sold. One of the 6 ft. Pelton wheels has been replaced by a Dodds of equal diameter, effecting a saving of 10 in. of water, which costs 18 cents per inch. E. R. Abadie, of Grass Valley, Superintendent.

*Odin Mine* (Drift).—See our XIth Report, p. 301. The property includes what was formerly known as the Nebraska and Live Oak ground along the Blue Tent road. Two ditches pass over the property, insuring a plentiful supply of water; one at a level of 60 ft. above the gravel washing pit and another about 120 ft. above; this latter water is employed for running the hoisting works, while the former supply is used for washing. The hoisting works are supplied with both water and steam power, the latter as a reserve, but is made use of at present for running a small steam pump at the foot of the incline to assist the ejector.

The bedrock tunnel from the foot of the incline shaft has a general easterly course, cutting across the channel which runs with the general direction of the ridge, swinging perhaps slightly to the west. A section through the channel shows the west rim pitching 6 ft. in the 100; the main channel having a width of about 225 ft. to where the bedrock rim raises on a slope of 6 in. to 100 ft., making the entire width 1,500 ft.

From the gravel worked to the top is 550 ft., including five different beds of gravel, with alternating pipe-clay and trachytic tufa capping. Along the flat east rim the gravel is low grade, the best not yielding over 75 cents per carload, while in the deepest part the carload value increases rapidly, enough to make the entire workable portion yield a good profit.





*SECTION THROUGH ODIN CHANNEL, HARMONY RANGE,  
NEVADA COUNTY.*

The present plan is to drive ahead upstream on the western or deepest side of the channel, then to breast out on both sides back to the incline, after which a new double incline shaft will be started between the Rock Creek and Snow Mountain ditches on the course of the channel.

The high rim has been traced from an old shaft in Keystone Ravine to the upper end of the Howe hydraulic pit. The gravel has to be removed rapidly in the present workings, the ground swelling badly. From 8 to 10 men breast on a shift, producing 10 cars to the man; the working force numbers 25. The dump-house holds 100 carloads; the gravel is washed twice a day, and each week the dump is washed down clean. The upper boxes are cleaned twice a week; the gold, which is exceedingly fine, is worth \$17 75 per ounce. The tailings are impounded and washed over again later. C. Hesse, of Nevada City, Superintendent.

*Omaha Consolidated Gold Mining Company (Quartz).*—See our VIIIth, Xth, and XIth Reports, pp. 433, 373, and 273. It is situated  $1\frac{1}{2}$  miles S. of Grass Valley, on Wolf Creek. The property comprises 2,400 ft. in length on the vein. It costs \$6 per ton to mine and mill the ore in this mine, using water power throughout, and employing in mine and mill about 75 men. Omaha Consolidated Gold Mining Company, of San Francisco, owners.

*Original Pittsburg Gold Mining Company (Quartz).*—This property is in Secs. 18 and 19, T. 16 N., R. 8 E., and Secs. 13 and 24, T. 16 N., R. 8 E.,  $2\frac{1}{2}$  miles N. of Grass Valley, comprising two claims (3,000 by 600 ft.). The course of the vein is N.  $2^{\circ}$  W., with a dip of about  $45^{\circ}$  E., and has an average width of 3 ft.; the quartz carries over 4 per cent of sulphurets. The present workings are carried on at the 500 ft. level; below this the mine is filled with water. On this level, drifts have been driven from the shaft a distance of 750 ft. N. and 280 ft. S. In the south breast a "crossing" has pinched the vein out, but from the surface indications it is plain that the vein continues beyond, and all that portion is virgin ground for 2,000 ft. A tunnel 280 ft. long is being

driven south of the main shaft to strike the vein 150 ft. below the surface. The entire plant, run by water power, is very substantial. See our VIIIth and XIth Reports, pp. 426 and 294. T. J. Furbee, of Grass Valley, Superintendent.

*Osborne Hill Gold Mining and Milling Company (Quartz).*—This property is  $2\frac{1}{2}$  miles S.E. from Grass Valley, controlling 2,100 ft. on the vein; patented. The vein courses N.W., dipping  $28^{\circ}$  W., and shows an average width of 14 in. Several ore shoots are known to exist, pitching south. The incline shaft is 450 ft. long and 250 ft. in perpendicular depth; the lower part is caved and filled with water. This shaft is being retimbered and cleaned out, and a pumping and hoisting plant erected to work the mine to a depth of 1,500 ft. Later a stamp mill will be erected, as a test run of the quartz shows the ore to be of high grade. The shaft is a double-compartment, 10 by 5 ft. in the clear; timbered with square timbers and closely lagged. The iron "T" rails used in the shaft weigh 12 lbs. per foot. Steam power will be used; cord wood (pine) costs \$3 25 per cord. Osborne Hill Gold Mining and Milling Company, of San Francisco, owners.

*Osceola Mine (Quartz).*—This is 1 mile S. from Rough and Ready, and comprises 1,500 by 600 ft. on the course of the vein, which is N.  $30^{\circ}$  E., dipping W., with an average width of 3 ft. The quartz contains 2 per cent of copper sulphurets. The developments consist of surface cuts, two tunnels, and a 70 ft. incline on the vein; in the bottom of the latter is a 3 ft. vein. The Excelsior Water Company's ditch crosses the south end of the claim, and would give about 60 ft. pressure. Moody & Gayety, of Gold Run, Placer County, lessees.

*Peabody Mine (Quartz).*—This mine, 1,200 ft. long, is south of and within the city limits of Grass Valley. It courses N.W. and S.E., dips  $30^{\circ}$  S.W., and is 4 to 20 in. in width. Admission was denied, but it is said to have been exploited to the depth of 440 ft., and that the rock was high grade. J. H. Von Schroder, Eugene de Sabla, Jr., and Alf. Tregidgo, of Grass Valley, owners.

*Pennsylvania Consolidated Gold Mining Company (Quartz).*—See our Xth and XIth Reports, pp. 383 and 276. It is in T. 16 N., R. 8 E., about  $1\frac{1}{2}$  miles from Grass Valley, and controls 2,900 ft. on the vein, the surface side-lines varying from 300 to 600 ft. in width. The vein has a course of N.  $33^{\circ}$  W., and dips  $60^{\circ}$  S.W., with an average width from 6 to 22 in. between syenite walls. The incline shaft has a total depth of 625 ft., sunk on a varying grade, the upper part pitching about  $60^{\circ}$  and the lower about  $36^{\circ}$ . At present the vein carries small stringers of quartz, and the work being prosecuted is in the nature of prospecting. Eighteen men are employed. Pennsylvania Consolidated Gold Mining Company, of Grass Valley, owners.

*Potosi Mine (Quartz).*—See Gold Flat.

*Providence Gold Mine (Quartz).*—This property has been described in our VIth, VIIIth, and XIth Reports, pp. 47, 418, and 290. It is the deepest mine working on the granite and slate contact in the district, having attained the depth of 1,350 ft. on the pitch of the vein. It carries two veins, designated as the *front* and *back* veins; the former on the contact and the latter in the granite, about 500 ft. apart, and connected by a cross-cut on the 1,250 ft. level. Deer Creek forms the northern boundary of the property, which embraces 150 acres. The vein courses N.E. and dips S.E. The stopes above the 1,250 ft. level

are the principal sources of the present ore supply. The vein, averaging 5 ft. in width, yields between 70 and 80 tons per day.

On the south the drift on the contact has been extended on the 1,350 ft. level over 900 ft., and on the 600 ft. level 2,200 ft. The driving and stoping are performed by the aid of two machine drills, an Ingersoll and an Eclipse, operated by an old style compressor run by a 3 ft. Dodd wheel. A 10 in. Cornish pump with  $3\frac{1}{2}$  ft. stroke, running five strokes a minute, handles the water, and is operated by a 4 ft. Pelton wheel, in connection with the hoist.

In the 40-stamp mill, 30 of the stamps are dropping; these weigh 800 lbs. each, and are run at a speed of 100 drops of 6 in., with from 2 to 4 in. discharge through No. 6 perforated Russian iron screens. The shoes are chrome steel, with a guaranteed life of 155 working days, costing in New York 6 cents per pound. The dies are iron, and are obtained at the local foundry, lasting 70 days. The duty of the mill is 2 tons per stamp per twenty-four hours. No plates are used inside the battery; on the outside is a mortar plate 14 in. wide, with a  $\frac{1}{2}$  in. to the foot pitch, followed by an apron 4 by 4 ft. set on a grade of  $\frac{3}{4}$  in. to the foot, succeeded by 12 ft. of double sluice plates, 12 in. wide. The mortar plate saves and retains 75 per cent of all that is caught on the plates.

The 12 Frue concentrators that are now in use produce from 3 to  $3\frac{1}{2}$  tons of sulphurets per day, which contain some cobalt and telluride. A new chlorination plant, of  $3\frac{1}{2}$  tons capacity, has been erected. The furnace is 65 ft. long by 11 ft., inside dimensions, with one step, 18 working doors, 12 in. height of firebridge. There are five gas tanks and five leaching vats, and four charges are made per day. Of the silver in the ore 85 per cent is saved. The furnace consumes three fourths of a cord of wood per twenty-four hours, usually cedar and pine, costing \$3 50 per cord. The company owns and cuts its own timber and wood; the lagging, 5 ft. long, costs \$4 50 per hundred. The company employs at present 80 men, 62 of these underground. Providence Mining Company, of San Francisco, owners.

*Rainbow Gold Mine (Quartz).*—The property is situated in the Eureka District, 6 miles N.E. of Washington, and an equal distance S. from Graniteville, in Sec. 34, T. 18 N., R. 11 E., and is being worked under a bond; it comprises 1,500 by 600 ft. The vein, 18 in. to 4 ft. wide, courses N.W. on a contact of porphyry and granite, the latter forming the foot-wall, and dips to the east. An incline shaft has been sunk 60 ft., and at present a tunnel is being driven to tap the vein below the shaft at a vertical depth of 140 ft.; it has reached a distance of 560 ft., and will require an additional 100 ft. before reaching the vein. A pay shoot pitching south has been traced 300 ft. The tunnel makes 2 in. of water. C. J. Garland, of Washington, owner.

*Reward Gold Mine (Quartz).*—This property is half a mile S.W. from Nevada City, and is a new undertaking. It is to the south of the Providence Mine on the California ledge immediately east of the Mountaineer Mine. The vein has a westerly course and dip, and lies in the granite. A shaft has been sunk 104 ft., and a steam pump and hoist are being erected. A long drain tunnel is now being driven from Deer Creek. R. C. Walrath, of Nevada City, Superintendent.

*Rocky Bar Mine (Drift).*—This property is on the Yuba River, one fourth of a mile E. of Washington, and comprises 3,000 ft. along the channel of the South Yuba River. A slide from the mountain on the



north side has covered the former channel, forcing the river over to the south, where it has cut a new channel, leaving a pronounced "run" between. On this an incline has been sunk 54 ft. deep at a pitch of 35°, and again 400 ft. farther up the channel a second incline is under way. A cross-cut of the channel shows a width of from 50 to 75 ft., with a depth of about 40 ft. of large, washed, granite boulders, on a slate bedrock. The pay is all on the bedrock. A drift has been run up the channel between the two inclines 400 ft. long, partly on the bedrock. Timbers are required solely to keep the large boulders from shifting. The gravel is hoisted by a 14 ft. overshot wheel and washed through 300 ft. of sluices, supplied with Hungarian and slat riffles, the boxes being set on a 4 in. grade. The gold is worth \$17 per ounce. A Chinese pump, run by a 15 ft. overshot wheel, keeps the mine dry. Cañon Creek furnishes 75 in. of water for power. J. O. and E. A. Hayes, of Hillsdale, Santa Clara County, owners.

*Rocky Bar Mine* (Quartz).—This property is described in our VIIIth Report, p. 483, and is situated on Osborne Hill. The vein courses E. and W. and dips 30° S., in slate, averaging 1 ft. in width. Only the southwest end of the claim is being worked, by several companies of tributors working on feeders to the main vein; 48 men are thus engaged. The ore carries about 4½ per cent of sulphurets. H. Sylvester, of Grass Valley, owner.

*Rocky Glen Mine* (Quartz).—See our VIIIth and XIth Reports, pp. 450 and 310. The property has four known veins: two with a northwesterly course and an easterly dip, about 1,200 ft. apart, and two coursing more westerly and pitching southwesterly. C. D. Eastern, of Graniteville, owner.

*South Idaho Consolidated Gold Mining Company* (Quartz).—This property, comprising 3,000 by 600 ft., is 1 mile E. of Grass Valley, on an E. and W. vein, dipping about 75° S. It is about 18 in. wide, between serpentine and slate walls, and is being opened through a three-compartment incline shaft 5 by 12 ft. It is 70 ft. deep to date (August, 1893), and is to be sunk 100 ft. South Idaho Consolidated Gold Mining Company, of Grass Valley, owners.

*Spanish Mine* (Quartz).—See our XIth Report, p. 292. Average width of vein is 3 to 6 ft., between syenite walls. The incline shaft is 4 by 4 ft. to a depth of 120 ft., increasing then to 4 by 7 ft. to a depth of 270 ft. Two levels have been run from the shaft both N. and S. to pay shoots; that on the south is 175 ft. distant, and has been stoped on for 85 ft. The north pay shoot has just been touched. In the drain tunnel a pay shoot 80 ft. long has also been stoped. The drift on the drain tunnel level is 600 ft. long; on the next level, 150 ft. deeper, the south drift extends 375 ft. A. Lord, of Nevada City, Superintendent.

*Spanish Mine* (Quartz).—See our VIIIth Report, p. 442. It is a noteworthy property from the fact that it is the lowest grade of ore that is worked in California, where the cost is kept below the yield; said yield in itself not being over 50 per cent of the assay value. At present but two of the Huntington mills are running, crushing over 70 tons per day. The loss of quicksilver in working this ore is nearly one third from flouring. The yield of gold is 85 cents per ton; the cost of mining and milling about 53 cents. The works are to be removed to the mouth of a tunnel 300 ft. below its present location. There are 15 men employed in and around the works. F. W. Bradley, of Wardner, Idaho, owner.

*St. Gotthardt Gold Mine* (Quartz).—This property is 4 miles N. of Columbia Hill, and controls two claims, 3,000 by 600 ft., on a N. and S. vein, with an easterly pitch in syenite, varying from a few inches to several feet in width. A two-compartment perpendicular shaft, 5 by 10 ft., has been sunk to a depth of 380 ft. At a point between 300 and 400 ft. from the surface the shaft cuts the vein. Levels run at 200 to 300 ft. extend N. 500 ft. and S. 200 ft. At 180 ft. from the surface the shaft is tapped by a drain tunnel from the river side. A tunnel is also being run from Grizzly Cañon, where the mill is to be erected, to cut the shaft 340 ft. in depth; up to date it has attained a length of 900 ft.; 400 ft. more will bring it to the shaft. Steam power is used; engine 30 horsepower, cylinder 8 by 12 in., and boiler 48 in.;  $1\frac{1}{4}$  cords of wood is consumed in twenty-four hours, costing \$1 95 per cord. G. T. Wayman, of Columbia Hill, Superintendent.

*St. Johns Gold Mine* (Quartz).—See our XIth Report, p. 281. It is in Sec. 22, T. 16 N., R. 8 E., and comprises 3,500 ft. on the course of the vein, with a variable width. The vein courses N. 30° E. and dips about 70° S., with a diabase hanging- and a talcose schist foot-wall; the vein averages 4 ft. wide. The developments are made through an incline 350 ft. deep, with four levels at the respective depths of 90, 150, 230, and 300 ft. A contract has been let to continue the incline down 500 ft. The present workings are east of the shaft on the 300 ft. level; on all the other levels they are to the west. A 10-stamp mill with 4 Frue vanners has been acquired by the company, but has not yet been erected. The sinking of the shaft to date is 50 ft. below the 300 ft. level, and costs \$50 per foot, and is being carried in the hanging-wall. St. Johns Gold Mining Company, of Grass Valley, owners.

*San José Gravel Mine* (Drift).—This property is in the Washington District, 6 miles E. of Washington, on Deer Creek, and is supposed to be a continuation of the channel worked by the Omega Company. It is being operated through a perpendicular shaft 340 ft. deep, well timbered, and closely planked; the gravel is hoisted in cars of 1,800 lbs. capacity, on safety cages. From the bottom of the shaft a bedrock tunnel is driven 600 ft. in the serpentine bedrock to the channel, which it crosses in 200 ft., about 18 in. higher than the lowest point of the channel, and is continued for 100 ft. in the north rim. Three upraises have been made in this portion of the rim; the first struck gravel at 15 ft., the second at 30 ft., but the third found no gravel in 75 ft. The general course of the channel is from E. to W. A drift has also been run 300 ft. up and 100 ft. down the channel. The gravel is dark, composed largely of cobbles of the country rock mixed with some quartz, and on the west side is covered with a layer of sand; the capping consists of 40 ft. of pipe-clay, and above that lava to the surface. The gravel drifts are carried about 7 ft. high. The mine makes about 6,000 gallons of water per hour, which is discharged by 6 in. and 8 in. Cornish pumps making six strokes per minute. Ventilation is supplied through a No. 2 Sturtevant blower, with 6 in. air pipes. The plant is operated by water power applied to three Pelton wheels under a head of 180 ft.: a 5 ft. wheel for the pumps, a  $4\frac{1}{2}$  ft. for the hoist, and a 6 in. for the blower, using in all 250 in. of water, costing \$1 per day. Peter Long, of Nevada City, Superintendent.

*Union Gravel Mine* (Drift).—This property is in North Bloomfield District, on Relief Hill,  $3\frac{1}{2}$  miles from Bloomfield, and consists of 90

acres of patented ground. It was formerly a hydraulic mine, but is now being worked by drifting.

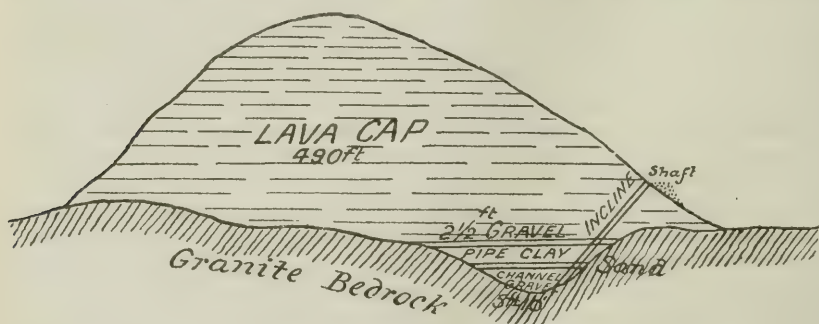
A tunnel is run north into the hill under the old hydraulic pit for 1,800 ft. in the slate bedrock, but develops no regular course for the gravel channel, which resembles more nearly a big slide from the ridge above, that has carried away parts of a former channel, or it may be an ancient bar. Both bedrock and gravel swell, making it hard to keep the gangways open. The gravel is over 40 ft. thick, capped with cement containing several strata of small quartz gravel. The channel is about 70 ft. wide and has been worked for about 300 ft. Intermixed with the gravel are clay and rotten serpentine boulders. The gangway runs about 8 ft. above the main tunnel. The gravel drifts are from 5 to 9 ft. wide, timbered with square sets. In the main drift the posts are  $6\frac{1}{2}$  ft., the caps  $4\frac{1}{2}$  ft., with 6 ft. spread. The mine has natural ventilation through passageways opening on to the bank, which are connected with the main tunnel; it is also self-draining, making about 2 in. of water.

The dump at the mouth of the tunnel holds 350 tons; a smaller one, for prospecting, 100 tons; the gravel is washed three times every two weeks; the gold is coarse. The sluices are set in sections in Union Cañon, with drops of 20 and 60 ft.; the tailings are being retained in the cañon. Slat riffles and old car wheels are used in the boxes. The water supply is drawn from the Malakoff ditch, 200 in. of water being used. The mine employs 20 men. Union Drift Mining Company, of North Bloomfield, owners.

*Wait for the Wagon Mine (Drift).—See Odin.*

*Washington Mine (Quartz).—*This mine is on the Yuba River, 6 miles E. of Washington. A 20-stamp mill is on the property. See our VIIIth and Xth Reports, pp. 440 and 391. A. Tregidgo, of Grass Valley, owner.

*West Harmony Gravel Mine (Drift).—*This property was described in our XIth Report, p. 300, and is in Sec. 5, T. 16 N., R. 9 E. Since then



SECTION THROUGH WEST HARMONY GRAVEL CHANNEL,  
NEVADA COUNTY.

a 15-stamp mill has been erected; it crushes about 6 tons per stamp per twenty-four hours. The stamps drop 4 in. 95 times per minute, discharging through No. 2 perforated tin screens with a double discharge. The aprons are 4 ft. long with  $1\frac{1}{2}$  in. grade per foot, followed by 16 ft. of double sluices 16 in. wide, and supplied with Hungarian riffles. Beyond the mill 100 ft. of sluices and a canvas plant are to be added.



The plates are scraped once a week; the batteries and sluices are cleaned once a month; the gold is worth \$17 50 per ounce.

The accompanying ideal sketch shows the relative positions of the different strata of the channel; it is 250 ft. from rim to rim. The bed-rock is very irregular in its grade along the channel, rising at times 4 ft. above the level of the drift, and again dipping below the established grade. The gravel drifts are carried 6 ft. high, using two caps on three posts. The channel has been developed for a length of 500 ft.—300 ft. down and 200 ft. up. Two shifts of men work in the mine. West Harmony Gravel Company, of Nevada City, owners.

*Winfield Scott Mine* (Quartz).—See our XIth Report, p. 283. It is 3 miles S.E. from Grass Valley, and has been worked by the Hartery Mining Company, which owns the adjoining claim. Winfield Scott and Hartery Mining Company, of Grass Valley, owners.

*Wyoming Gold Mining Company* (Quartz).—This claim was described in our VIth and XIth Reports, pp. 48 and 291, and is in Sec. 11, T. 16 N., R. 8 E. The present workings at the south end comprise an incline shaft 900 ft. deep on the pitch of the vein. The vein being worked is the most westerly of the series; the same one as the back vein of the Providence Mine, 500 ft. from the contact, with which it unites at a depth of 500 to 600 ft. No stoping is being done. The only pay taken out is derived from running the drift ahead. Wyoming Gold Mining Company, of San Francisco, owners.

*W. Y. O. D. Mine* (Quartz).—This property is S. of Grass Valley. Admission to the mine and all information were refused. See our VIIIth, Xth, and XIth Reports, pp. 435, 379, and 268. W. Y. O. D. Mining Company, of Grass Valley, owners.

#### ORANGE COUNTY.

Included among the mineral resources of this county are gold, silver, lead, zinc, coal, copper, and cinnabar, none of which are mined extensively. Of all the minerals, coal has hitherto been the most prominent, but it is probable that some day petroleum may become the leading mineral production.

Several prospectors were engaged, in 1894, in searching for gold in Trabucco Cañon, about 30 miles E. of Santa Ana. Their discoveries were not of a promising character, however. The workings were in a light gray feldspathic porphyry, carrying iron sulphurets and a small amount of gold, too little to pay.

#### PLACER COUNTY.

Though containing a very large area of auriferous gravel deposits, yet from the great diversity of its resources, Placer County has suffered less in its advancement and material prosperity through the closing of its hydraulic mines, than any other portion of the State. Here, as in other parts of the great mineral belt of the State, capital is beginning to inquire into the possibility of resuscitating and developing the quartz interests, which have, up to the present, taken only a secondary place in the production of gold. More especially is this to be noted in the Ophir and Duncan Hill districts, which, from the mineral character of their veins, presented difficulties to the earlier quartz miners that made suc-

cess in their operations doubtful. Better acquaintance with the treatment of this class of ores at the present day, and improved methods of working, have largely removed the difficulties, and this section of the country may be expected soon to take a prominent position as a gold producer, as well as a favored land of fruit.

The large drift mines on the Forest Hill and Iowa Hill divides are pushing their developments ahead with uniform success, and as the courses of these ancient channels are more plainly understood, new sections are being opened, with every prospect of remunerative returns. It is much to be desired that the work of mapping these ancient river courses, so ably commenced by Ross E. Browne, E.M., and others, and which were given to the mining public in our Xth Report, might be extended over a large area.

*Allbright Claim (Drift).*—It is 2 miles E. of Penryn, and was formerly hydraulicked, but is now being prospected by drifting. A bedrock tunnel has been run in the slate 500 ft., and from the end an upraise of 32 ft. extends into the gravel, but little pay was found. The water issuing from an old tunnel on the ground is used for washing, through six boxes with 1 in. grade to the foot; slat riffles are used.

*Alta Development Company's Mine (Drift).*—It is at Alta, on the C. P. R. R., and comprises about three quarters of a mile on both the "White" and "Blue" channels. A tunnel, whose estimated length to tap the latter is 2,000 ft., is now being excavated. Towle Bros. & Gould, owners; Col. J. E. Doolittle, of Dutch Flat, manager.

*American Bar Mine (Quartz).*—This property is  $2\frac{1}{2}$  miles S.W. from Michigan Bluff, and contains two locations of 1,500 by 600 ft. The vein courses N.E. and dips  $45^{\circ}$  E., between slate walls, from 8 to 40 ft. apart. It is worked by three tunnels; the lowest is 250 ft. beneath the surface. These tunnels are 150, 300, and 1,500 ft. in length; the upper one is connected with the surface by a 40 ft. shaft. The quartz carries some iron sulphurets and a little galena. Near the river is a 10-stamp mill, with 850 lb. stamps, run by a "hurdy" wheel. J. Nougés et al., of San Francisco, owners.

*Baker Divide Mine (Drift).*—See our VIIIth Report, p. 466.

*Barton Mine (Drift).*—This claim is 3 miles E. of Rocklin, in Sec. 20, T. 11 N., R. 7 E., and consists of 40 acres. It is an old river channel, presumably part of the delta of the precursor of the present American River, on a granite bedrock. The gravel deposit is 60 ft. deep and without capping; the bottom 6 or 7 ft. are mined. The gravel is cemented, containing no boulders; the cobbles are very uniform in size, about like a man's fist. The gold is fine and flaky, and sells for \$19 per ounce. The mine was opened in 1892, and has been worked to date through an upright circular shaft 6 ft. in diameter and 60 ft. deep. A second incline shaft farther down the channel will be ready for use shortly; it is 250 ft. on the incline. Through the circular shaft, not timbered, the car with 500 lbs. of gravel is hoisted by a horse-whim. The gravel is delivered to a Cox pan, which disintegrates the cemented gravel and passes it to the sluices; these are 200 ft. long, 16 in. wide, 12 in. deep, lined with Hungarian riffles, and set on a grade of 1 ft. to the box. Fifty carloads can be delivered to the pan in twelve hours. The tailings dump into Secret Ravine.

The width of the deposit worked is 350 ft.; the elevation above sea-level of the bedrock is 240 ft. The quantity of water used is 30 in., but

after the incline shaft is completed 60 in. will be used under 110 ft. pressure from the South Yuba Ditch Company, through 2,700 ft. of iron pipe 15 in. in diameter. Water is available all the year. A Worthington pump, working four hours per day, discharges the water from the mine. Dr. O. L. Barton, of Rocklin, owner.

*Belvoir (Boulder) Extension Mine* (Quartz).—This property is in the Ophir District, 3 miles N.W. from Newcastle. The claim comprises 1,500 by 600 ft. on the vein, which courses N. and dips 45° E., and has a width of several feet; the country rock is a dioritic granite. It is an old mine being reopened. A shaft has been sunk 150 ft. and preparations are being made to drift. L. Ferguson et al., of Ophir, owners.

*Ben Franklin Mine* (Drift).—This claim, in Forest Hill District, is near Yankee Jim's, and comprises 160 acres on Swindle Hill. It is an ancient channel, capped with 200 ft. of cement, near the forks of Brushy and Devil's cañons, coursing N. and S.; the elevation of the bedrock is 2,350 ft. It is worked through a bedrock tunnel 1,200 ft. in length, which cost \$12 per foot, and lies 20 ft. below the channel. The gravel is cemented, carrying about 60 per cent of bowlders and cobbles; the gold is worth over \$19 per ounce. The gravel breasts are 25 ft. deep, and the drifts are 3 ft. high. Very little timbering is required, only an occasional post and cap. Ventilation is obtained by a water-blast. The water used (100 in.) is brought from the neighboring cañons through a mile of ditch. J. N. Burke et al., of Yankee Jim P. O., owners.

*Big Dipper (Harmon) Mine* (Drift).—This claim was described in our VIIIth Report, p. 472, under the name of the Harmon Mine, and is in New York Cañon, between Prospect and Wisconsin hills, in the Iowa Hill District. The property contains four locations, comprising 200 acres on a channel coursing N. and S. and over 200 ft. wide. The gravel has a depth of 130 ft., with a slight soil capping, and carries from 60 to 70 per cent of cobbles and bowlders; it is cemented. The gold sells for \$18 15 per ounce. The bedrock tunnel, 37 ft. below the channel, is 700 ft. in length, requiring no timbers, and cost \$6 25 per foot. There are two air shafts: one 73 ft. deep and the other not connected yet; these were sunk for \$4 per foot. The two gangways are respectively 350 and 390 ft. long, and cost \$4 per foot. The channel breasts are 370 ft. wide and the gravel is drifted 6 ft. high; these drifts are timbered with single posts and caps 8 ft. apart. The main tunnels are driven by Ingersoll drills worked from a Firth & Rix compressor. Two shifts of 15 men are employed, taking out from 65 to 70 carloads (2,200 lbs.) per day. They have worked 1,200 ft. of the channel up to a late date. Bryan rollers were used in crushing the cemented gravel; these are being replaced by 10 stamps of 950 lbs. weight, calculated to crush 70 tons per day. The plant is supplied with both steam and water power. The source of the water supply is Shirt-tail Cañon, whence it is brought through 7½ miles of ditch and delivered under 173 ft. pressure. There are 37 men employed. C. Waterhouse, of San Francisco, owner.

*Boulder Mine* (Quartz).—This property is situated 3 miles N.W. from Newcastle, in the Ophir District. The claim consists of 900 ft. on the line of a 3 ft. vein, which courses N. 10° E., dipping 45° E. The walls are grano-diorite. The mine is opened by shaft and tunnel, both connected at a depth of 115 ft. The tunnel runs with the ledge for 300 ft.;



near the tunnel mouth the vein is faulted. Three different ore shoots pitching east are being worked. The quartz is ribboned and glassy and carries sulphurets. Dr. M. Schnabel, of Newcastle, owner.

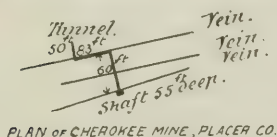
*Breece & Wheeler (Paragon) Mine* (Drift).—See our VIIIth and Xth Reports, pp. 467 and 455. It is  $2\frac{1}{2}$  miles E. of Forest Hill. At the present time two shifts of 15 men work in the mine, extracting 37 car-loads of one ton each per shift. The gold is worth \$18 per ounce. Messrs. Breece & Wheeler, of San Francisco, owners.

*Buttes Mine* (Quartz).—See our VIIIth Report, p. 461.

*Cedar Creek Mines* (Placer).—They are near Dutch Flat, and consist of gravel beds of vast extent, having an original depth of over 400 ft., and extending for over 6 miles without any capping. The channel has a top width of 1,500 ft. and 600 ft. on bottom, carrying pay throughout. Over 150 ft. of the bottom gravel is untouched. The general course of the channel is N. and S.; below Dutch Flat it forks, one branch going to the S.W. the other to the S.E. Up to date over \$8,000,000 has been taken from this ground, and it is estimated that double this amount is awaiting recovery. In one of the hydraulic pits a shaft has been sunk through the gravel 150 ft. to bedrock, showing good pay all the way down. The gravel is not cemented. Some of the bowlders have been crushed in a small mill, and gave small returns in gold; at present quartz bowlders are shipped from here to the smelter for flux. Efforts are to be made to work portions of the ground by drifting. Gould et al., of Dutch Flat, owners.

*Champion Mine* (Quartz).—This property is  $1\frac{1}{2}$  miles S. from Turkey Hill, and is idle at present. The claim contains two locations on the southern extension of the Daniel Webster. The vein courses N. and S., dipping  $75^\circ$  E., between slate walls. Developments consist of an incline shaft 40 ft. deep on the vein, connected with a tunnel 150 ft. in length, with a second tunnel 50 ft. lower, cross-cutting for the vein. C. Knopfel, of Michigan Bluff, owner.

*Cherokee Mine* (Quartz).—It is in the Last Chance District, 16 miles E. of Michigan Bluff, and consists of 1,500 by 600 ft. The main vein is 18 in. wide, in slate walls, and courses N.W. and dips  $70^\circ$  E. The quartz is of ribbon structure, carrying about 2 per cent of iron sulphurets. There are three seams in all. On the bank of Deep Cañon 500 ft. of fall for water power can be obtained.



*Columbia Gold and Silver Mining Company* (Quartz).—They own 3,200 ft. on a vein in the Ophir District, 7 miles W. from Auburn. The property, which comprises 250 acres of ground, is owned in Denver, Colo., and besides the mine, contains considerable agricultural and fruit land. The elevation is about 500 ft. above sea-level. The vein has an average width of 4 ft., and can be traced by the outcrop along its course, which is N.  $10^\circ$  W.; it dips  $84^\circ$  E. The walls are grano-diorite. Several feeders of prominence make into the vein in the company's ground from the west. The developments under the present management include three shafts, the erection of a hoisting plant and a new mill, besides several buildings for boarding-houses, offices, etc. There are three shafts available for working purposes. The main shaft, in the mill building, is a double-compartment, 5 by 13 ft. in the clear, furnished with double-reel hoisting gear. At the south end of the claim is the

former working shaft, 630 ft. deep, but at present filled with water. The third shaft, between these two, has just been started. The quartz carries 0.5 per cent of sulphurets. The mill is the Huntington rotary, with Woodbury concentrators. The ore-bin is constructed to carry 250 tons. The works will be lighted with electricity. The water power, derived from the South Yuba Canal Company's ditch, furnishes 410 ft. fall through one mile of pipe, which is applied to a 4½ ft. Dodd wheel for the hoist, a 6 ft. Pelton wheel for the compressor (running 12 Ingersoll drills), a 5 ft. Pelton wheel for the mill, and two 18 in. Pelton wheels for the concentrator and dynamos. Forty-five men are employed. Columbia Gold and Silver Mining Company, owners; B. F. Hartley, of Auburn, Superintendent.

*Crater Mine* (Quartz).—This property is in the Ophir District, 1 mile N.W. from Ophir. The course of the 2½ ft. vein is N. 80° W., dip 48° S. It is near the contact of the grano-diorite and amphibolite, but wholly in the latter. A shaft 800 ft. deep is on the vein. At present two men are overhauling the very extensive dumps. C. F. Reed, of Auburn, owner.

*Daniel Webster Mine* (Quartz).—This property is in the Forest Hill District. The claim consists of 1,500 ft. by 600 ft. on a vein coursing N. and S., dipping 75° E., between slate walls; its width is from 3 to 6 ft. It has been developed through three tunnels; the longest is 125 ft., and gives 75 ft. backs on the vein; at present a tunnel is being run south of the old works. Mrs. S. A. Powers, of Michigan Bluff, owner.

*Dardanelles Mine* (Drift).—This claim was described in our VIIIth Report, p. 464, and is situated in the Forest Hill District, 1½ miles S.W. from the town of Forest Hill. It contains 312 acres, and is operating on two beds of gravel. The bedrock tunnel, 2,700 ft. long, is run on a N.W. course, from the end of which an incline 330 ft. long, on a one third pitch, reaches the bottom of the channel, which has a N. and S. course. The elevation of the bedrock at this point is 2,551 ft. The gangway extends 630 ft. up the channel. The breasts are from 70 to 80 ft. wide, and are run 6 ft. high. The cemented gravel carries about 40 per cent of cobbles and boulders. The gold is small scale, from .883 to .886 fine. At the head of the incline is an electrical engine for hoisting, capable of developing 500 volts; also an electrical pump, which is run four hours per day, discharging a steady stream through a 4 in. pipe. The bedrock tunnel, incline, and principal stations are lighted by incandescent lights calculated to burn for one thousand hours. The mill is furnished with both steam and water power, the latter being brought from Volcano Cañon through 9 miles of ditch and delivered under 300 ft. pressure. The water season lasts from November to July. J. Hamilton, of Auburn, owner.

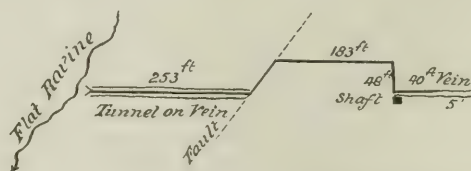
*Dorrer Mine* (Quartz).—This is situated in the Humbug District, near Damascus, on the South Fork of the North Fork of the American River, and consists of a claim 1,500 by 600 ft. The vein courses N.W. and dips about 80° E. It has an average width of 4 ft., and is between slate walls. The developments consist of three tunnels, 40, 200, and 200 ft. long, about 100 ft. apart and 80 ft. below the surface, and are connected therewith through an air shaft. The tunnels are run on the foot-wall slate and require no timbering. The pay shoot has been followed for 150 ft. without reaching the end, and about 40 ft. of the ground has been stoped. An incline tramway 3,000 ft. long, on a 35° grade, connects the mine with the 10-stamp mill. The mill is supplied with a

grizzly, a Dodge rockbreaker, Tulloch ore-feeder, and 950 lb. stamps, operated by a 3 ft. Knight wheel under a 30 ft. head. Several thousand inches of water can be supplied. The plating in the mill consists of a 4 ft. apron and 12 ft. of sluice plates, 14 in. wide, set on a pitch of  $1\frac{1}{2}$  in. to the foot. The quartz carries 2 per cent of iron pyrites, chalcopyrite, galena, and zinc-blende. The sulphurets are not saved. Five hundred tons of ore were crushed last season. Timber is abundant. Dorrer Bros., of Towles, owners.

*Drummond Mine (Quartz).*—See our Xth Report, p. 424. It is situated between the North and South Forks of Shirt-tail Cañon. The property comprises 360 acres of excellent timber land, through which the Drummond ledge courses, and also its probable feeder, known as the Eclipse; the latter has lately developed some extremely rich quartz. The two veins are about 400 ft. apart. Tunnels have been run on both veins; that on the Eclipse shows rich quartz in the breast. In the bottom of the works on the Drummond is a  $2\frac{1}{2}$  ft. vein of quartz. The steam mill contains two 5 ft. Huntington mills, a Blake crusher and Hendy self-feeders, 10 ft. of apron plates, and a Johnston and two Frue concentrators. B. F. Reed, of Auburn, owner.

*Eclipse Mine (Quartz).*—See our Xth Report, p. 433. It is near Ophir.

*Flat Ravine Mine (Quartz).*—This property is on Canada Hill, and comprises 1,500 by 600 ft. on a N.W. vein dipping  $60^{\circ}$  E. The foot-wall is slate, the hanging-wall porphyry, with 3 ft. of quartz between. The quartz carries 4 per cent of sulphurets, mostly iron. A shaft has been sunk 47 ft. on the pay shoot, and 598 ft. of tunnel run. A cross-cut has been run, and the shaft will intersect it at a depth of 177 feet. The mine is at the foot of Bald Mountain, at an elevation of 6,000 ft. above the sea. There is no mill on the property. M. Savage, of Michigan Bluff, owner.



PLAN OF FLAT RAVINE MINE, PLACER CO.

*Golden River Mine (Drift).*—See our VIIIth and Xth Reports, pp. 476 and 456. It is situated  $2\frac{1}{2}$  miles E. of Damascus. The company owns  $3\frac{1}{2}$  miles of the channel. There are three ancient channels on this divide on different levels; the upper, or white channel; the second, 30 ft. lower, has gravel, partly quartz and partly metamorphic rocks; and the lowest, 60 ft. below, known as the blue channel. The cement capping varies from 4 to 1,000 ft. in thickness. In the blue channel the gravel varies in thickness from 7 to 16 ft.; its course is a little N. of E. The elevation of the bedrock above the sea is 3,853 ft.; that of the bedrock in the nearest ravine, 3,813 ft., and the level of the North Fork of the American River is 2,000 ft. lower. The mine is opened through a bedrock tunnel 23 ft. under the channel.

From 75 to 100 carloads of gravel are extracted per day, working two shifts with 16 white men and 30 Chinese; the iron cars have a capacity



of 22 cu. ft. (one ton). The gravel, taking the average for the last five years, is valued at \$2 50 per ton; cost for extraction, from \$1 25 to \$1 60 per carload. The gravel is mostly free. The channel drifts are carried 10 ft. wide, and the gravel drifts are from 7 to 16 ft. in height. The gravel has 33 per cent of cobbles and boulders, all stowed in the mine.

For washing the gravel, water is brought from Humbug Cañon and collected in a tank 16 by 16 by 8 ft., and this amount of water, under a 36 ft. head, washes 20 carloads of gravel, which passes through 50 ft. of boxes with slat and Hungarian riffles; these are cleaned every two or three days. The gravel then passes through 180 ft. of boxes that are cleaned once a month, and 100 ft. of ground-sluice, then through 100 ft. of flume, finally passing through a series of parallel boxes followed by a drop. Blocks, car wheels, and riffles are used in the lower series of boxes, also quicksilver. The boxes are 15 in. wide and have a 1½ in. grade to the foot.

The gold is scaly, very uniform in size, and .932 to .937 fine, equal to \$18 90 per ounce. The average production since 1888 has amounted to over \$60,000 per annum. One mile of the channel has been worked. Golden River Drift Mining Company, owners; C. H. Hoffman, of Damascus, Superintendent.

*Gold Blossom Mine* (Quartz).—See our Xth Report, p. 431. It is situated 1½ miles N.W. of Ophir, and comprises 6,000 ft. on a vein running nearly E. and W. and dipping slightly S. A new 20-stamp mill is now (September, 1894) being erected on the property. A plant was erected here to work by the MacArthur-Forrest process, but was abandoned for lack of success. Col. B. F. Reed et al., of Newcastle, owners.

*Gold Run Ditch and Mining Company* (Hydraulic).—Their property is at Dutch Flat. The channel courses N. and S., the gravel being several hundred feet in depth. It has yielded largely in gold. Gould et al., of Dutch Flat, owners.

*Green Mine* (Quartz).—This property is near Ophir, immediately E. of the Crater vein, and shows an 18 in. vein, with heavy mineralized walls, and is "pockety." A shaft has been sunk on the vein about 300 ft. deep. An old 8-stamp mill stands on the property.

*Harmon Mine* (Drift).—See Big Dipper.

*Hidden Treasure Mine* (Drift).—See our VIIIth, IXth, and Xth Reports, pp. 469, 120, and 451. It is in the Michigan Bluff District, comprising an area of 704.56 acres, through which the "white" channel of the divide passes. At the point of present working the channel is known to be 1,300 ft. wide from rim to rim. The volcanic capping reaches a depth of 650 ft., with 150 ft. of underlying gravel. The elevation at the top of the deposit is 4,550 ft., and the underlying bedrock 3,700 ft. above the sea-level; while Blacksmith's Ravine adjoining is about 2,900 ft.

The bedrock is a soft, swelling slate, which is one of the main considerations in the working expenses of the mine. The main tunnels have the timber sets 2 ft. apart, using 8 ft. posts and 5 ft. 4 in. caps, in the clear, with a 12 ft. spread, no mudsills being used, and extremely heavy "T" rails for the track, 30 lbs. to the foot. The tunnels are closely lagged. If left to themselves, these tunnels entirely fill up in two years, twisting and breaking the heaviest timbers. The channel drifts are carried 100 ft. wide, the ground divided into 200 ft. blocks, and half worked from either side diagonally; later, commencing at the back, the

pillars are removed. The gravel drifts are carried 6 ft. high, timbered with posts and caps, the latter joining. Breast boards and false sets have to be used with breasting gravel, and the lagging has to be kept driven up close. Notwithstanding these precautions occasional parcels of the ground are lost. Three hundred carloads of gravel, each 1 ton in weight, are extracted per day, said to have averaged \$1 35 per car during the previous season. The timber account of the mine varies from \$750 to \$1,000 per month, at a cost of \$5 per 1,000 ft., running measure. One hundred inches of water is used for washing, under a 20 ft. head. Up to date 1,000 ft. of channel has been worked. A total of 126 men are employed; of these 88 are Chinese. In washing the gravel the first few boxes are cleaned up every day, the following 1,400 ft. of flume once a month, and all below that once a year. For the present the mine has let a timber contract for 1,712,133 ft. of mining timbers, including lagging. H. T. Powers et al., of Sunny South, owners.

*Lady Bedford Mine* (Quartz).—This property is 7 miles S.E. from Westville, and 10 miles E. of Michigan Bluff. The vein courses N. and S., dipping 50° E., with an average width of 8 ft., between a slate foot-wall and a porphyry hanging-wall. The quartz is of ribbon structure, carrying 1 per cent of iron pyrites with some galena. The croppings, which are quite prominent, can be traced for 1 mile. The developments are a 30 ft. tunnel running north, with an upraise of 60 ft., which cuts a 6 ft. vein. A 2-stamp mill, with 250 lb. stamps, crushes nearly a ton of quartz in twenty-four hours, using a No. 30 perforated screen; the apron is 8 ft. long. Page et al., of Michigan Bluff, owners.

*Live Oak Claim* (Drift).—See our VIIIth Report, p. 474.

*Manhattan Mine* (Drift).—See Weske Mine.

*Mammoth Bar Mine* (Placer).—Is on the North Fork of the American River, 5 miles from Auburn, and embraces 10,000 ft. along the river. The gravel is worked by hydraulic elevation. See our Xth Report, p. 417. Col. Davis, of Auburn, owner.

*Marguerite Mine* (Quartz).—This property is half a mile from Auburn. The claim contains 1,500 ft. on the course of the vein under an agricultural patent. The vein runs N.W., dipping 73° W., with a width of 2½ to 5 ft., between walls of serpentine. The quartz carries 7 per cent of sulphurets, iron, chalcopryrite, and galena, and is of glassy texture. The present workings consist of an incline shaft 115 ft. deep, double-compartment, 5 by 9 ft. in the clear. Eighty gallons of water are hoisted per day with a horse-whim. A 9 in. blower produces the ventilation, being run by a 1½ horse-power steam engine. After further development, a mill and chlorination works are to be erected. G. F. Deetken, of Auburn, owner.

*Mayflower Gravel Mine* (Drift).—This claim was described in our IXth and Xth Reports, pp. 120 and 453, and comprises 1,400 acres in parts of Secs. 22 to 27, inclusive, as also parts of Secs. 14 and 15, in T. 14 N., R. 10 E. The mine is situated 3 miles N. of Forest Hill. Up to date there have been worked 3 miles of the lower channel and 2,000 ft. on the Orono channel. With 34 men on the shift, the present output is 80 carloads of 1¼ tons per shift; two shifts are employed. The water supply is obtained from Shirt-tail and Blackhawk cañons, through 12 miles of ditch, and is delivered under a head of 340 ft. The water season lasts from November to July. The company is supplied with an Ingersoll boring outfit, which is used in prospecting and locating the course of the

channel through their property, finding the depth to bedrock, and putting down holes for ventilation. Mayflower Gravel Mine, owners; J. L. Jones, of Forest Hill, Superintendent.

*Morning Star Mine* (Drift).—This property, described in our VIIIth, IXth, and Xth Reports, pp. 472, 111, and 420, is in Indian Cañon, half a mile from Iowa Hill, at an elevation of 2,644 ft. The present output of gravel is 75 carloads, of 1 ton each, said to yield an average of \$7 50 per ton, the gold being worth over \$18 per ounce. Forty men are employed. Over 1,000 ft. of the channel has been worked. Morning Star Mining Company, owners; J. H. Neff, of Colfax, President and Superintendent.

*Mountain Gate Mine* (Drift).—See our VIIIth Report, p. 468.

*Old Pacific Mine* (Quartz).—This is the west extension of the Gold Blossom Mine, and controls 1,000 ft. in length on the vein, which courses E. and W., dipping to the S. The vein is 18 in. wide, and several shafts, ranging from 40 to 90 ft., have been sunk. The ore extracted was all shipped. Dr. M. Schnabel et al., of Newcastle, owners.

*Osborne Mine* (Quartz).—This is 4 miles S.E. of Westville, and controls 1,500 by 600 ft. on a N. and S. vein, 8 ft. wide, dipping 80° E., between slate walls. The developments consist of a tunnel on the ledge, 300 ft. long, and an 83 ft. shaft.

*Paragon Mine* (Drift).—See Breece & Wheeler.

*Pioneer and Lynn Mines* (Quartz).—This property is in the Towles District, 2 miles W. of Damascus. There are eleven locations included in the property, each 1,500 by 600 ft., on several veins. The course of the vein is slightly to the E. of N., and dip 80° E. The country rock is slate, with a porphyry foot-wall. There are four different tunnels opening on the veins; the upper one 300, the second 200, the third 400, and the fourth 1,400 ft. in length. The latter is the main working tunnel, 5 by 6½ ft., and cost \$10 per foot. Little timbering is necessary.

The main pay shoot on the Lynn vein is opened for a length of 400 ft.; it pitches S., and has been stoped on the entire length. About 10 in. of water issues from the tunnel. The ventilation is supplied through a 520 ft. shaft, connecting with the lower tunnel. A No. 2 Baker blower is provided for special occasions.

The ore is trammed in 1-ton cars by hand to large bins on the surface, situated at the head of an incline tramway, which is 2,700 ft. long, with a changing slope, and leads direct to the mill, 1,100 ft. perpendicularly below. The two cars on the incline carry 2 tons each, the full down car bringing the empty one up.

The ore carries a small percentage of sulphurets, with occasional bunches of arsenical pyrites. The mill contains a double grizzly of 12 bars, 12 ft. long, 3 in. apart, ½ in. wide, set at an angle of 45°, leading to a Blake crusher. The usual Hendy self-feeder operates from the center stamp. The 20 stamps, weighing 750 lbs. each, drop 90 times per minute, with a 5 in. drop, and discharge through a No. 30 slot-punched screen, set with a slight inclination. The steel shoes and dies have an average life of 90 days. The water is applied both inside and outside the battery. The battery has an inside plate, as well as one on the lip of the mortar. The outside plating consists of an apron 4 ft. long, and 12 ft. of 18 in. sluice plates, all set on a grade of 1½ in. to the foot. The plates are scraped every day, and the batteries cleaned once a month. Below are 8 Frue concentrators. The sulphurets are shipped.



The motive power is water derived from Damascus and Quartz cañons, conducted through 2 miles of ditch. Thirty inches of water is delivered through an 11 in. pipe, under 600 ft. pressure, on three Knight wheels of 3 ft. diameter each.

The company have had to build 6 miles of graded road at a great expense. Thirty men are employed; miners get \$3, millmen \$2, and Chinese \$1 75 per day. J. G. Fair et al., of San Francisco, owners.

*Rising Sun Mine* (Quartz).—See our VIIIth Report, p. 462. S. D. Valentine et al., of San Francisco, owners.

*Salsic (Smith & Fulweiler) Mine* (Quartz).—This property is half a mile N.W. of Auburn. The present works are on a vein coursing N. 45° W., and dipping 75° E. An incline is being sunk on a vein 1 ft. wide, between slate walls. The quartz is glassy, with a small percentage of iron sulphurets and some galena; the rock shows free gold in some places. Two men are at work, using a windlass. Smith & Fulweiler, of Auburn, owners.

*Sellier Mine* (Quartz).—This is 1½ miles E. of Forest Hill, in the Bath District, and controls 5½ acres of patented ground. The vein courses E. and W. and dips N. nearly vertical, between slate walls, and has an average width of 2 ft. A tunnel is being started to cut the vein at about 120 ft. in depth. Former works show a shaft 84 ft. deep, with a 4 ft. vein in the bottom. Sellier & Son, of Bath, owners.

*Small Hope Mine* (Drift).—This property is in Brushy Cañon No. 2, about 3½ miles N. of Forest Hill, and contains 40 acres. A prospect tunnel is started from the cañon and runs 2,000 ft. in slate bedrock. Next above the bedrock is 5 ft. of cemented gravel that carries a good grade of pay, while above it is a pay streak of gravel of lower grade. A spring-pole stamp and hand mortar are used to break up the cement, which is then washed through four sluice-boxes with slat riffles. W. D. Craneage et al., of Forest Hill, owners.

*Southern Cross Mine* (Quartz).—This property is situated on the bank of the American River, about 3 miles N.W. from the Pioneer Mine, and consists of two claims 3,000 by 600 ft. The vein courses N. 12° W., and dips 62° E. The veins are designated as the East, Middle, and West veins, and their respective widths are 40 in., 5 ft., and 2½ ft., with a distance of 175 ft. between E. and W. veins; the walls are slate. Two tunnels have been started to develop the E. and W. veins; that on the latter starts 30 ft. above the river and has been driven 25 ft. The tunnel on the E. vein is about 400 ft. above the river, and has attained a length of 40 ft. The former tunnel is intended to be the main working tunnel, from which cross-cuts will be driven to intersect the others. The croppings on the E. vein show pay ore for 400 ft. The quartz carries a large percentage of arsenical pyrites, and shows considerable free gold in spots. A 20-stamp mill is in process of construction, which is to be run by water power obtained from the river. Fourteen men are employed. C. L. Ford et al., of Towles Station, owners.

*St. Lawrence Mine* (Quartz).—See our VIIIth Report, p. 461. It is 3 miles N.W. of Newcastle, in the Ophir District, at an elevation of 650 ft. above the sea, and comprises 1,300 by 600 ft. on an E. and W. vein, 20 in. wide, and with a dip of 35° E. The walls are grano-diorite. The quartz is glassy, and contains about 4 per cent of sulphides of iron, lead, and antimony. The bullion is from .650 to .700 fine. The developments consist of a shaft and two tunnels. The shaft is intersected at a depth

of 171 ft. by the upper, and at 300 ft. by the lower tunnel. Two ore shoots pitching east are being developed, one 180 ft., and the length of the second not yet determined, though 100 ft. long to date. Only a few timbers are required in the mine; they cost  $2\frac{1}{2}$  cents per running foot, delivered.

The mill contains a Brodie rockbreaker with 18 in. jaws, a set of Cornish rollers, Hendy self-feeder, and a  $3\frac{1}{2}$  ft. Huntington mill. The apron plate is 4 by 11 ft., beneath which is a double mercury trap and a Johnston concentrator, which handles 9 tons in twenty-four hours. Below the concentrators are a Wheeler pan and two settlers. The sulphurets are shipped to San Francisco. Twelve men are employed. Col. C. F. Reed, of Ophir, owner.

*Weske (Manhattan) Mine (Drift).*—This claim was described in our Xth Report, p. 442. It is  $1\frac{1}{2}$  miles N.E. of Forest Hill. When visited preparations for reopening the property were being made, it having been idle for some time. — Weske, of Michigan Bluff, owner.

## PLUMAS COUNTY.

The old gravel channels are one of the main reserves of California, and Plumas County will long figure as a prominent gold producer, as many of the known channels that have yielded so much wealth in the adjoining counties appear to have their source within her boundaries, and a great deal of unexplored ground is awaiting the advent of capital. But it is not alone as a gold producer that the mineral reputation of this county will be sustained. It can take a front rank with the other mineral counties of the State in the production of silver, copper, iron, and zinc ores, as soon as railroad transportation is afforded. The timber resources all through the county are vast and of superior quality, and available water power of the best kind is abundant, so that the natural facilities in connection with the mines are favorable for the development of the mineral wealth of the county.

*Altoona Gold Mine (Quartz).*—Described in our Xth Report, p. 472, and is between Round Valley and Crescent Mills. During the past season the drifts have been extended along the vein.

*Alturas Mine (Placer).*—A tailings claim on Slate Creek. See our XIth Report, p. 332.

*Bear Mine (Quartz).*—This property is 14 miles from Prattville. The vein is 5 ft. wide; course N.W., dip N.E. The walls are slate. F. C. Mandeville, of Butte Valley, Superintendent.

*Beckwith Consolidated Gold Mine (Drift).*—This claim is 7 miles S.W. from Johnstown, in T. 22 N., R. 11 E., and comprises 500 acres, but is undeveloped. A tunnel run into the ridge from the east has caved. E. McNeil et al., of Beckwith, owners.

*Blind Lead Gold Mine (Quartz).*—See our Xth Report, p. 475. An upraise of 20 feet has been made from the lower tunnel into the vein, which is now being stoped. These stopes have to be very substantially timbered with square sets and lagged overhead. The quartz carries cubical sulphurets and are not saved. The 10-stamp mill, run by steam, receives the ore direct from the mine, and employs battery amalgamation with apron plates alone. D. McIntyre, of Greenville, owner.

*Brandt Gold Mine (Quartz).*—This property is in Genesee Valley, in the slate belt, and has lately changed owners, who are erecting a

10-stamp mill with concentrators, and making other improvements previous to starting up the mine. Brandt Gold Mining Company, owners; G. Brandt, of Genesee Valley, Superintendent.

*Bushman & Orr (Blackhawk) Mine* (Quartz).—It is in Blackhawk Ravine. See our XIth Report, p. 328. D. Bushman et al., of Quincy, owners.

*Butterfly Mining Company* (Quartz).—This property is situated in Seneca township, 5 miles N.W. from Quincy, in T. 24 N., R. 9 E. The vein is 3 ft. wide, and strikes N. Both walls are slate. Three tunnels, and a shaft about 100 ft. in depth, constitute the developments. C. Thompson et al., of Spanish Ranch, owners.

*Cayot Mine* (Quartz).—This property is near the southern boundary of Plumas County with Butte, in Goodman township, about 14 miles N. from Forbestown. The formation is granite, with very large crystals of mica. There are five locations, running N.E. and S.W. with the course of the veins, which dip about 70° N.W. The developments are on the most westerly vein. Two tunnels are driven about 20 ft. above each other, the lower running nearly W. and the upper S.W. At 30 ft. in the upper and 80 ft. in the lower tunnel a 5 ft. vein of quartz was cut, and a crushing of 200 tons of quartz is being taken from it. The quartz shows free gold and a good percentage of sulphurets, iron, copper, zinc, and lead. F. Cayot, of La Porte, owner.

*Centennial Mine* (Drift).—This property is on the North Fork of the Feather River, 10 miles S. of Prattville, in T. 26 N., R. 8 E. A prospect bedrock tunnel has been driven a distance of 250 ft., and gravel is showing on the top of the tunnel. J. S. Bransford, of Quincy, owner.

*Centennial Mine* (Drift).—Another mine with this name was described in our XIth Report, p. 325, and lies 4 miles N.W. from Quincy. But few developments have been made. Challen et al., of Spanish Ranch, owners.

*Consignee Mine* (Drift).—See our XIth Report, p. 330.

*Crescent Mill and Mining Company* (Quartz).—See our VIIIth and XIth Reports, pp. 481, 469, and 330. Their property is in Sec. 24, T. 26 N., R. 9 E. The present workings are confined to the 400 ft. level, all above the 200 ft. level being practically worked out; between the 200 and the 400 ft. levels the lode shows from 70 to 85 ft. wide, practically barren. The present work is entirely exploratory. Drifts have been run both E. and W. for several hundred feet, but nothing better than \$2 per ton rock has been encountered. The drift makes considerable water—354 gallons per minute. Down to the 200 ft. level there was no distinct walls to the vein; below this, the trap walls are very decided, with a slight gouge on both sides. Sixteen stamps of the mill are run on custom work. Crescent Mill and Mining Company, owners; A. W. Whitney, of Crescent Mills, Superintendent.

*Cub Mine* (Quartz).—This property is in T. 23 N., R. 8 E., 14 miles S.E. from Prattville, and contains two claims, 3,000 by 600 ft. The vein is from 14 to 20 ft. wide, courses N.W. and dips S., between slate walls. A shaft 20 ft. deep and a tunnel 40 ft. long have been started on the vein. The quartz carries iron and arsenical pyrites. A 2 in. gouge in the foot-wall carries a large percentage of sulphurets. The Cub Mining Company, of Butte Valley, owners; F. C. Mandeville, Superintendent.

*Diadem (Edman) Mine* (Quartz).—See our Xth and XIth Reports, pp. 486 and 323. It is situated on Mumford Hill, 12 miles W. of Quincy.



Mr. Edman reports having discovered in the ores of this mine selenium and also wulfenite. He has also found in the fine sands of Gopher Hill, near Spanish Creek, platinum and osmium-iridium. Edman et al., of Meadow Valley, owners.

*Drury and Pacific Gold Mine (Quartz).*—See our Xth Report, p. 473. It is situated on the edge of Round Valley, 2 miles W. of Greenville, in T. 26 N., R. 9 E. The property comprises three claims and two large timber tracts, and also controls the Round Valley reservoir, which has an area of over 4,400 acres. The vein is a very large fissure filled with syenite, traversed by seams and veins of quartz. The course of the vein is N.E. A serpentine belt occurs about 600 ft. distant. The mine is worked through tunnels, the upper one being over 1,600 ft. long. On this level and from there to the surface the present ore supply is taken, which is hauled half a mile to the mill on the opposite side of the cañon. The lower tunnel, 250 ft. deeper, and extending 1,200 ft. into the hill, shows a better grade of ore. A new mill is to be erected below the mouth of this tunnel. The ore shoots in the fissure are short and change from one wall to the other. No connection has been made between the two tunnels; the lower one is ventilated by a "water-blast" with 6 in. air pipes. Timbers last about five years in the mine and cost 3 cents each. The 20-stamp mill is closed during the winter, on account of the difficulty in hauling. G. Standard et al., of Greenville, owners.

*Dubuque (Bell) Mine (Quartz).*—See our Xth Report, p. 478.

*Dutch Hill Mine (Drift).*—This property was described in our VIIIth Report, p. 482, and is 7 miles from Prattville, at an altitude of 5,000 ft. During the past season a new bedrock tunnel has been run to the upper works on the channel, shortening the distance over which the gravel has to be trammed, from half a mile to 500 ft. From where the gravel was struck the tunnel was continued, quartering across the channel for 300 ft., the opposite rim not having been reached yet. This tunnel cost \$4 50 per foot. The lava capping, as shown in the air shaft, is 325 ft. thick, and lies directly on the gravel without any pipe-clay intervening. The gravel wash consists of greenstone, red jasper, and quartz, with occasional lava boulders. The pay is all within 4 in. of the bedrock, and is best where the ground has the most boulders. One foot of the bedrock is picked up in cleaning. The pay streak runs irregularly in the gravel, which is slightly cemented, and a "breaster" can take out 5 tons or carloads per shift. The gangways are carried with 4½ ft. posts and the breasts are 35 ft. wide; single posts and caps are used. Ventilation is secured through an air shaft. There is a flow of 20 in. of water, which is used for washing; the dump holds 25 carloads. Washing is done twice a day, and the first cross-riffles are cleaned up every twenty-four hours. There are three lines of sluices, 12 by 14 in., with two intermediate drops of 5 and 10 ft., and a tailings reservoir. The boxes are cleaned up every three months and the tailings sold and rewashed every two years; the last washing yielded \$400 net. Dutch Hill Mining Company, owners; W. Savercool, of Butte Valley, Superintendent.

*Elizabethtown Gravel Channel Mining Company (Drift).*—See our Xth Report, p. 478.

*Emigrant Mine (Drift).*—This property is about 2½ miles N. of Quincy, and comprises 80 acres, of which 5 acres have been worked. Course of channel, E. and W. Developments consist of a 70 ft. shaft and 45 ft. of drift; also an open cut with the bank from 6 to 100 ft. in depth. The

gravel, dark blue, is from 6 to 8 ft. deep. The breasts are carried 20 ft. wide and the drifts 4 ft. high. R. L. Bell, of Quincy, owner.

*Fall River Consolidated Mine* (Quartz).—This property is on Fall River, half a mile above the Plumas and Butte county line, and comprises 230 acres, including 160 acres of fine timber land; also a water power from Fall River with 90 ft. head, which can be increased to 115 ft. by running a new ditch. Two of the claims are patented; the remainder is held by possessory title. There are three veins, coursing N.E. in granite. Developments consist of two tunnels running N. of W. The upper one, 250 ft. long, crosses the front vein 30 ft. from the mouth, turns and runs S. on the vein 715 ft., showing 12 in. of quartz in the breast. After cutting the second vein the tunnel swings to the S. and follows an 18 in. vein of quartz. The lower tunnel, at the mill level, runs 950 ft. northwesterly, cutting the first vein 800 ft. from the mouth, where it turns both N. and S. on the vein, which is from 2½ to 5 ft. wide; the north drift is 250 ft. and the south drift 90 ft. long, exposing two short ore shoots. The tunnel was continued 60 ft. to the No. 2 vein, and a short distance beyond. No. 2 is 1 ft. wide where crossed. The quartz in these parallel veins carries about 3 per cent of sulphurets, iron, copper, zinc, and lead. The ore shoots pitch apparently to the S. About 5 in. of water issues from the tunnel. Ventilation is provided through an air shaft and water-blast, using 12 in. square wooden air boxes. The power of the mill is applied on a 5½ ft. Pelton wheel, with a 22 in. water pipe. The mill is supplied with a home-made self-feeder and one Frue concentrator. — Walters, of Gibsonville, owner.

*Franklin Consolidated Gold Mine* (Drift).—It is 5 miles W. of Poker Flat, and 9 miles S.W. from Johnstown. It contains 480 acres. It is a "white quartz" channel, and is supposed to have a N. and S. course, but has not been thoroughly developed yet. It carries a heavy wash, with coarse gold scattered through the entire depth of the gravel. The gold sells for \$18 per ounce. Two tunnels have been run into the lava, both too high. The ground is well supplied with timber. D. McFarlan et al., of Beckwith, owners.

*General Harrison Mine* (Drift).—It is situated in Goodman township, 9½ miles from Gibsonville. It contains 40 acres of ground. No regular channel has been developed, the gravel being more in the nature of an outbreak or overflow from the McRae Ridge. The bedrock is slate; the capping cement and pipe-clay. The developments consist of a bedrock tunnel, 110 long; the gravel, 5 to 6 ft. deep, carries coarse gold. C. H. Radcovich, of Johnsville, owner.

*Genesee Valley Mine* (Quartz).—See our Xth Report, p. 476.

*Glazier Mine* (Drift).—See our Xth Report, p. 495.

*Golden Reef Mine* (Drift).—It is locally known as the Shores Ravine shaft, and is on Spanish Creek, 2 miles W. of Quincy. The company own 2 miles of the creek at its entrance into American Valley. A double-compartment shaft has been sunk to a depth of 66 ft., and a drift run S. 149 ft. across the course of the channel. At the distance of 117 ft. the tunnel cut through the rim into the gravel, but it was found to be too high. After reaching the south rim it is intended to run up channel till bedrock is struck. The plant consists of a steam hoisting works of 40 horse-power and a 12 in. jackhead pump, which raises about 5 in. of water. Agassiz & Shaw Company, of Boston, owners.

*Green Mountain Mine* (Quartz).—This property was mentioned in our VIIIth and Xth Reports, pp. 479 and 471. Though one of the notable mines of the county, at present it is working but a small crew of men, and only 25 stamps of the 60 are dropping. J. Goodwin et al., of Quincy, owners.

*Hallsted Mine* (Quartz).—See our XIth Report, p. 326. J. Hallsted, of Spanish Ranch, owner.

*Hibernia (Pennsylvania) Mine* (Quartz).—This property is 2 miles S.W. from Greenville, and is patented. The vein courses N.W. in syenite walls, and is from 5 to 12 ft. wide. An interesting feature of this property is that for the last twenty-five years the hillside facing the valley and below the vein has been slowly moving down to the valley; the cause of this movement has never been determined. See our Xth Report, p. 473. J. O'Toole, of Greenville, owner.

*Indian Valley Mine* (Quartz).—See our Xth Report, p. 472.

*Jamison Mine* (Quartz).—This property is on little Jamison Creek, in Secs. 25 and 26, T. 22 N., R. 11 E., and contains 500 acres, partly quartz and partly placer ground. It has an extensive water system, consisting of several lakes that overflow into one situated on the mountain overlooking the works, which are three fourths of a mile S.E. from Johnsville. The formation is diorite, carrying a series of quartz veins of varying width, mostly with a flat pitch of about 15°; the narrower the seams, the richer the quartz. The mine is opened by a shaft 160 ft. deep, connecting in the bottom with a drain tunnel 1,800 ft. long, which discharges into the Little Jamison Creek. The shaft has three compartments, 5 by 6 ft. in the clear. Machine drills are used. There are 3,000 ft. of 2 in. air pipes used in the mine. The power is derived from two 6 ft. Pelton wheels working under 460 ft. pressure. Tests of the ore made in the Plumas-Eureka mill show that a large proportion of the quartz is high grade. Thirty-five men are employed. Jamison Gold Mining Company, owners; S. Cheney, of Johnsville, Superintendent.

*John Bull Gold Mine* (Quartz).—This is in North Cañon, near Greenville. The claim, though 1,500 by 600 ft., has not been taken up on the course of the vein; consequently only 450 ft. of the vein belongs to the mine. Two other claims, known as the *Long Tom* and the *Phoenix*, belong to the same parties and adjoin the John Bull. The course of the John Bull is about S. 52° W., dip about 60° N.; the course of the Phoenix is N. and S., with a vertical dip. The width of the former is 20 ft. and of the latter 1 ft. The developments of the John Bull consist of two tunnels starting from the bed of North Cañon and about 50 ft. apart. The lower cross-cuts for 280 ft. and turns on the vein 200 ft.; the upper follows in on the vein 250 ft. Both are connected through stopes, and 70 ft. in length and 50 ft. in height of the vein has been stoped above the upper tunnel. The tunnel on the Phoenix extends 400 ft. on the vein, and some stoping has been done both above and below the tunnel level. The 5-stamp mill is run by a hurdy wheel with 100 ft. pressure. Cost of water, \$3 for twenty-four hours. S. Firmstone et al., of Greenville, owners.

*Kings Gravel Mine* (Drift).—This property is on the North Fork of Feather River, 12 miles S. from Prattville, and embraces 90 acres. A tunnel runs N.W. in slate bedrock 300 ft., which strikes the bottom of the channel and is continued across about 200 ft. No breasting has been done yet. The gravel is similar to the present river wash, but is



slightly cemented and lava-capped, but has no pipe-clay. Ventilation is secured by a "water-blast" and 6 in. air pipes. Thirty carloads of gravel is the present output; this is washed once a day. The gravel is taken out 4 ft. high. Fred Scott et al., of Greenville, owners.

*Long Tom Mine* (Quartz).—See John Bull Mine.

*Lucky S. Mine* (Quartz).—See our Xth Report, p. 467.

*Megown Mine* (Quartz).—See our Xth and XIth Reports, pp. 484 and 324.

*Mountain Chief Mine* (Quartz).—This is on the west branch of Mill Creek, 4 miles S.E. from Quincy. The claim is 1,500 by 600 ft., on a belt of clay and quartzose slates, interspersed with quartz seams varying from a few inches to several feet in thickness. These seams bear a little W. of N., ranging with the formation, and dipping about 55° W. The property is being opened 225 ft. above the level of the creek, where a shaft has been started. On the creek is a 12 ft. arrastra, with horizontal wheel, using 4 tons of drag rock, having a capacity of 4 tons in twenty-four hours. The entire 4 tons are put in at once and ground for twenty-four hours. Plates are used with good results. The quartz carries some sulphurets. Timber and water are plentiful. G. Ellis, of Quincy, owner.

*New Jersey Claim* (Drift).—It is 11 miles N. of Gibsonville, on Nelson Creek. The property consists of 240 acres on the north end of Blue Mountain. A tunnel has been run 240 ft. in pipe-clay, and a shaft sunk 88 ft., showing 50 ft. of gravel; then 9 ft. of pipe-clay, followed by 12 ft. of gravel, and below that again pipe-clay. In the upper 50 ft. of gravel, there are 15 ft. carrying very large boulders. Each separate layer of gravel contains gold in paying quantities. This channel is supposed to be a part of the Bunker Hill or Gibsonville channel, though some refer it to the Monte Cristo channel. It carries white quartz gravel, iron-stained for a short distance below the cement. Ventilation is produced through an 8 in. pipe in the shaft, with coal-oil lamp burning below it. Thomas Chapman, of Gibsonville, owner.

*'93 Quartz Mine* (Quartz).—This is near the Sulphur Creek ranch, 5 miles from Mohawk, and comprises 1,500 by 600 ft. The 3 ft. vein courses N. and S. and dips about 60° E. The foot-wall is slate, the hanging-wall a soft rotten rock. The prospect shaft is 80 ft. deep. A water power of 500 in. and 30 to 40 ft. fall can be had by half a mile of ditch from the mine. Timber is plentiful.

*Ohio Mine* (Placer).—This is 6 miles S.E. from Mohawk, and contains 120 acres. The gravel bank, which is just being opened, has a depth varying from 2 to 15 ft. of free gravel, containing considerable large boulders, on a slate bedrock. Snow water, lasting three months, constitutes the water supply; it is retained in a small reservoir. The gold, worth \$19 50 per ounce, is both coarse and fine; the former usually adhering to quartz. Eight boxes 3 ft. wide, set on a grade of 1 in. to the foot, and paved with block and rock riffles, are used for washing; an undercurrent 6 ft. wide is to be put in later. The quicksilver is scattered over the ground before the washing commences, and the clean-up is made at the end of the season. J. C. Knickrem et al., of Mohawk, owners.

*Phoenix Mine* (Quartz).—See John Bull Mine.

*Pilot Hill Gold Mine* (Quartz).—This property is situated at the foot of Pilot Hill, 6 miles N.W. from Gibsonville, at the head of Onion Val-

ley, at an elevation of about 7,000 ft. The property includes six claims, with two veins running nearly parallel and about 600 ft. apart, coursing nearly N. and S. and pitching toward each other. The average width is 5 ft. Several feeders make into the same veins, and these are heavily mineralized, carrying large bunches of arsenical pyrites, said to assay very high. The abruptness of the mountain side facing Poorman's Creek gives excellent opportunities for tunneling to the vein. Several tunnels have been started from this side. P. F. Turner et al., of Gibsons ville, owners.

*Plumas-Eureka Mine* (Quartz).—This property was described in our VIIIth Report, p. 476, and is near Johnstown. The present workings are now confined to near the summit of the peak, in what is known as the "76" ground. Only 30 of the 60 stamps were dropping, and the present working force is 130 men. Plumas-Eureka Gold Mining Company, owners; T. Jenkins, of Johnsville, Superintendent.

*Plumas Imperial Gold Mining Company's Mine* (Hydraulic).—It comprises 900 acres of ground, on Hungarian Hill,  $4\frac{1}{2}$  miles S.W. from Quincy, and 300 acres on Emigrant Hill, 2 miles N. of Quincy; the latter ground includes three quartz ledges. The present operations are confined to the gravel deposit near Hungarian Hill, at what is known as the Five Points, where there is a gravel bank of 102 ft., capped by soil and some pipe-clay strata. Near the slate bedrock the bottom is covered with heavy boulders. The upper portion is small gravel, and belongs to the youngest of the three gravel deposits that are found throughout this section of country. The present pit extends about 200 ft. and is 102 ft. deep. The supply of water is obtained from Deer and Rock creeks and their tributaries, through two series of ditches, 6 and 9 miles in length, giving a pressure of 380 ft., although under the present operations only 250 ft. of pressure is used. A 5,000 ft. pipe-line of No. 14 iron conveys the water to the "giants," reducing from 22 in. to 15 in., and throwing the stream through 7 in. and 4 in. nozzles. The ditches have a capacity of 1,200 in.; the water season lasts ten months. Two sets of flumes are used, 4 and 3 ft. in width, paved with block and rock riffles. The dump is into Rock Creek, where a restraining dam has been built 30 ft. wide at the base, 17 ft. on top, and 20 ft. high, of solid rock, half a mile below the present pit. The gravel prospects throughout its entire depth, but is richest on the lower 6 ft. The gold sells for \$18 per ounce. Timber of fine quality is on the ground, and a sawmill is within  $2\frac{1}{2}$  miles of the property. Plumas Imperial Gold Mining Company, owners; Col. Day, of Quincy, Manager.

*Quincy Mining and Water Company* (Hydraulic).—This claim is on Gopher and Shores Hill, on the north bank of Spanish Creek, 6 miles W. of Quincy, and comprises 2,200 acres. The channel, which courses E. and W., belongs to a period later than the main lava flow, and is worked about 400 ft. wide. The present bank (110 ft. high) is capped with pipe-clay, strata of which are found also in the gravel. The gold in the upper courses is not as coarse as that below the bottom strata of pipe-clay; it is all valued at \$19 50 per ounce. The source of water supply is Spanish Creek and its tributaries, Bean Creek, Little Bean Creek, also Gold and Silver Lake on Spanish Peak. They use 1,400 in. of water, delivered from the ditches under a pressure of 350 ft., using 6,000 ft. of pipe, No. 14 iron, reducing from 22 in. to 15 in., and ejected from two giants with 6 in. and 7 in. nozzles. There are 2,500 ft. of 4 ft.

sluices set on a 6 in. grade, besides 860 ft. of a bedrock flume on a 10 in. grade. Both are paved with rocks, and supplied with quicksilver. A clean-up of the head boxes is made every twenty days. The company employs 24 men at wages varying from \$1 50 to \$1 75 per day with board. Quincy Mining and Water Company, owners; W. C. Ralston, of San Francisco, Secretary.

*Salmon Falls Mine* (Drift).—This property is in Seneca township, and is S.E. from Prattville; it comprises 100 acres on the North Fork of Feather River. A tunnel has been run 400 ft. in the trap-rock close to the falls to cut the Glazier channel, and is being continued. The lava capping at this point is about 400 ft. D. McIntyre et al., of Greenville, owners.

*Savercool Mine* (Quartz).—See our Xth Report, p. 493.

*Shenandoah Mine* (Quartz).—See our XIth Report, p. 324. The 10-stamp mill has been moved to the immediate proximity of the mine, and they are driving the main tunnel ahead, developing some very good ground. Capt. J. W. Smith et al., of Oakland, owners.

*Specimen (See and Seren) Mine* (Quartz).—See our Xth Report, p. 490.

*Wildcat Mine* (Drift).—This property is in T. 26 N., R. 8 E., 10 miles S. of Prattville. A tunnel has been started 3 ft. above the level of the North Fork of the Feather River, and run for 300 ft. The channel is 75 ft. wide, apparently a former bench of the present river. The pay is confined to the bedrock. Wildcat Drift Gravel Mining Company, owners; A. Cameron, of Prattville, Superintendent.

#### RIVERSIDE COUNTY.

This county, formed by an Act of the last Legislature from portions of San Bernardino and San Diego counties, has mining industries and mineral resources of great value. The complete equipment and operation of the Good Hope Mine, near Perris, has given a decided impetus to mining in all the region thereabouts, and several new prospects are being opened and old ones rehabilitated. The largest coal mine in the southern part of California is in this county, near Elsinore. Clay deposits and marble are also abundant and continue to be actively worked. In the extreme eastern part of the county, on the desert, new mines have recently been discovered, equipped, and are in successful operation.

An ancient river-bed may be traced for a long distance north and south in this county. The source of this old channel, which is gold-bearing, is to the north, but its exact locality is unknown. The indications are, however, that several small streams have united to form the main channel, which may be followed without difficulty from 2 miles N. of Good Hope for several miles in a southerly direction toward the town of Elsinore. Where the channel reaches the San Jacinto River it is several hundred feet in width, and upwards of 100 ft. in depth. In the cañon of the San Jacinto River may be seen either two or three channels, or else the remnants of one extremely crooked one. As these ancient river-beds are not at all developed, excepting by the shallow erosion of their upper portions by the recent little ravines and gulches, there is much that would be interesting concerning them, that for the present must remain unknown. Although no attempt has yet been



made to systematically work these deposits, or even to prospect them, beyond the sinking of several shafts, it is nevertheless a significant fact that every little ravine and gulch cutting through this old river-bed has contained gold, and in most instances has been worked by the Mexicans years ago. Signs of work in later years are also numerous, and at one point an old prospector was endeavoring to make a living by "rocking" the gravel of the old river channel. If sufficient water for hydraulic operations were obtainable the old river-bed might be found to produce a large quantity of gold. The channel was followed for about 5 miles, but it being evident that to trace it out and map it would require a season's work, it was abandoned for the time being.

*Alice Mine (Quartz).*—This is a new discovery 4 miles S. of Menifée P. O. It was opened to a depth of 10 or 12 ft. in several places, and a shaft was being sunk in the hanging-wall granite, which was calculated to reach the vein about 20 ft. from the surface. The only advantage in this shaft over one sunk directly on the vein was apparently in the fact that the country rock was much softer than the vein quartz, which was extremely hard and dense, having a fine granular texture. Wilson & Crane, of Winchester, owners.

*Barker Mine (Quartz).*—See Dos Palmas. C. O. Barker, of Banning, owner.

*Charity Mine (Quartz).*—See Free Coinage.

*Colorado (Justice) Mine (Quartz).*—This is 4 miles S. of W. from Perris. The vein is small, but the quartz is high grade. Knight et al., of Perris, owners.

*Dos Palmas, Gold Prospects Near.*—There is a group of gold mines on the Colorado Desert 18 miles N. of Dos Palmas Station, which was not visited by the field assistant, but which from descriptions by trustworthy persons may be looked upon as valuable prospects. The veins are of good size, fissures of strength, and ore of good grade. Water is obtainable within 6 miles of the mines, at a place called Cañon Spring. One of these claims is described as being located between two cañons 1,500 ft. apart. The crevice is 3 to 6 ft. wide, and the pay shoot 1 to 3 ft. Two tunnels, one of 90 and the other of 190 ft., have been driven in on the vein.

*Fish Mine (Quartz).*—It is in the Cañon Springs region, and the little work done shows a fine vein of gold-bearing rock.

*Free Coinage and Charity Mines (Quartz).*—These are two locations, made in 1893, about 5 miles N. of Cañon Springs, 12 miles N.E. of Dos Palmas. The vein in the Free Coinage has 28 in. of free-milling ore and a 6 in. vein of quartz, containing galena and carbonate of lead. This ore also contains some silver. E. E. Bowles, of San Diego, owner.

*Gavilan Mine (Quartz).*—This is owned by the San Jacinto Estate (limited), of London, and has been idle since the spring of 1892. See our XIth Report, pp. 366 and 368. Pedley Bros., of South Riverside P. O., agents.

*Good Hope Mine (Quartz).*—This is about  $4\frac{1}{2}$  miles S.W. of Perris. The mine has had quite an interesting history, being formerly owned and worked by Mexicans and subsequently by American owners. It is now the property of a Massachusetts corporation, and for the first time in its history is well equipped and being systematically developed. No. 1 level is 250 ft., No. 2, 350 ft., and No. 4, 450 ft. from the surface, the sump extending 35 ft. lower. The first and second levels are each 800

ft. in length, and the third 60 ft. long, and was being extended. The mine occurs in a gray, homogeneous, syenitic granite. Near the surface there are several veins at distances varying from 3 to 20 ft. apart. These, in depth, appear to unite, forming a somewhat irregular fissure with a branching tendency. The development of the mine thus far indicates that the offshoots pass into the foot-wall side. The fissure is at times poorly defined and again is clear, accompanied by a heavy clay seam, the result of long continued movement and the crushing of the rock immediately adjacent to the place of movement, into powder. The vein quartz itself also shows clearly the effect of this movement in a complete fracturing of the massive rock, and the subsequent infiltration of carbonate of lime into the small interstitial spaces thus formed. This renders a great deal of the quartz friable, it usually crumbling and slacking on exposure. The vein commonly appears as two separate bands of irregular size.

The fissure, it would seem, was what might be called a double fracture, a vein of quartz forming on each fissure plane. The foot-wall streak at some points contains a very high-grade ore, carrying finely disseminated iron sulphurets. The quartz is free milling, though ordinarily carrying more or less auriferous iron sulphuret of high grade. A very complete and exceptionally well-constructed 20-stamp mill has just been built and other surface improvements made. The mill contains 4 Frue vaners and 2 Johnston concentrators. Unfortunately during the unusually dry season of 1894 there was a scarcity of water, but this can be remedied by developing several springs in the neighborhood. A most encouraging feature in the Good Hope is the solid shape taken by the vein in the bottom. The quartz is well defined, the contact of granite and quartz is well marked, and never at any point where examined was it found "frozen." The indications are that the fissure is one of great depth and longitudinal extent, whatever character and value the quartz veins may be found to assume in the undeveloped portions of the mine. In June, 1894, there were employed in the mine and mill and in other surface work 65 men. There are two good shoots of ore, and these are being opened and blocked out as rapidly as possible. When the necessary information has been obtained concerning their pitch, etc., a new double-compartment working shaft will be sunk. The main working shaft, now having a total depth of 485 ft., has but one compartment.

Several hundred feet north from the main shaft a strong dike of dark-colored basic rock cuts the country, striking E. and W. At several points along its course this dike is shattered and crushed by movements which have taken place subsequent to its injection. At these points iron oxide appears and the rock is gold-bearing. The dike consists of two distinctly different rocks, and may be, in fact, two separate injections. One of these rocks is aphanitic, hard and black, resembling some diorites. The other variety is coarsely crystalline, resembling greatly some of the diabase of the "Mother Lode" region, and particularly that near Chinese Camp, in Tuolumne County. As at this writing no microscopic study has been made of either of these rocks, they are classed provisionally. The dike intersects the course of the vein, but whether the dike or the vein is the older is unknown. The underground workings of the mine have not penetrated as far north as the intersection of these two fissures, and the surface intersection is obscured by the ancient river-bed mentioned at the beginning of this chapter.

Good Hope Mining Company, owners; John M. S. Egan, of Perris, Superintendent. See our VIIIth, IXth, and XIth Reports, pp. 527, 151, and 106.

*Hexahedron Mine* (Quartz).—It is 7 miles N.E. of Piñon Mountain. The shoot of ore lies on the side of a hill. It is 75 ft. long, 15 to 20 ft. in thickness, and dips  $45^{\circ}$  N. The ore occurs as a mineralization of a felsitic dike, which strikes nearly E. and W. At the west end it is small (not over 4 ft.), but widens in going east. It passes from the south to the north side of the range of hills in which it occurs, and at the place where gold was found, lies exposed along the hillside, the overlying rocks having been eroded. Dikes of dark green diorite, much decomposed at the surface, have been thrust into the felsite and adjoining rocks in a very irregular manner, and in this vicinity the felsite contains gold. A small amount of iron oxide, copper carbonate, and dendritic infiltrations of manganese oxide are the only indications suggesting ore. The most ordinary rock, having nothing in its appearance to suggest that it is gold-bearing, is seen on closer inspection to be spangled with small points of gold. In the vicinity of the Hexahedron Mine are some small prospects, on which a few holes have been sunk. Ed. Holland and A. G. Tingman, of Indio, owners.

*La Ploma Mine* (Quartz).—See Victor.

*Leon Mine* (Quartz).—This is one of the latest discoveries. It is situated on the Briggs ranch, 4 miles E. of Menifee P. O. This section is about 14 miles S.E. of Perris. Where exposed, the quartz is from 1 to 2 ft. in thickness. A shaft has been sunk 50 ft. and a cross-cut tunnel run about 25 ft. toward the vein at a point lower down the hill. From a prospective standpoint it had a promising appearance. The rock prospects well, and occasionally the particles of gold are large enough to see with the unaided eye. Briggs Bros., of Leon, owners.

*Little Maggie Mine* (Quartz).—It is  $3\frac{1}{2}$  miles W. of Perris, on several small fissures in syenitic granite. The quartz found in this mine is high grade. It is crushed in an arrastra. A cross-cut tunnel to intersect the main fissure at a depth of 40 ft. was being run. There are numerous claims in this section, located on these little fissures in the granite, but none of them except this were being operated. J. M. Hasson, of Perris, owner.

*Lost Horse Mine* (Quartz).—It is 7 miles N. of Piñon Mountain, at an altitude of 5,000 ft. The vein strikes E. and W., and dips  $85^{\circ}$  N. It cuts through a formation striking N. and S., composed for most part of a laminated micaceous quartzite, of granular appearance. Occasional dike-like masses of granite also occur, but the vein cuts everything else. It is exposed at several points along its course for a distance of 800 ft. Its width is from 6 in. to 5 ft., and exhibits the overlapping tendency, the foot-wall becoming the hanging-wall of the next shoot below. The mine is worked by a small force, the rock being hauled 8 miles to the Piñon Mountain mill. With more abundant water and a mill having greater capacity, this property, which consists of two claims, should become a large producer. The mine is 19 miles N. and a little E. of Indio in a direct line, and about 28 miles by wagon road. Lang, Holland & Tingman, of Indio, owners.

*Lucky Boy (Walker) Mine* (Quartz).—It was discovered in the spring of 1892, but was idle during the summer of 1894, as considerable water was encountered in sinking, and the owners, being men of limited means,



make slow progress in the work of development. See our XIth Report, p. 385. Luke Walker, of Menifee, owner.

*Monte Negras Mines* (Quartz).—Very little has been done here since 1892. A few tons of ore were packed out and worked in the small stamp mill at Virginia Dale, but with what results was not learned. In most cases the assessment work had not been performed, and many of the claims have been relocated. See our XIth Report, p. 368.

*O'Brien Mine* (Quartz).—This is 1 mile W. of Good Hope Mine, and comprises 1,500 by 600 ft. Mrs. O'Brien, of Perris, owner.

*Onward Mine* (Quartz).—It is one of a group discovered recently on the Colorado Desert between Virginia Dale and the Colorado River, and about 45 miles S. of Danby Station, on the A. & P. R. R. The quartz is mostly very ferruginous, some of it jaspery, and usually oxidized and honeycombed, showing gold. The district is not a large one, comprising a group of isolated hills which rise out of the desert plain. Lum Gray & Bro., of Phoenix, Arizona, owners.

*Piñon Mountain District*.—The mines are in the desert about N. 30° E. from Indio 12 to 14 miles, at an altitude of about 5,000 ft. above the sea, Indio being nearly 200 ft. below sea-level. The several more prominent veins have a N.W. strike and a variable dip. They are all branching fissures of that peculiar type common to massive rocks such as granite. Often the fissures consist of a single slip, but more frequently two walls may be seen. These are not usually parallel for any considerable distance, but approach in strike and dip, and finally meet where the ore or gold-bearing material is "pinched" out, but it is generally found on the opposite side of one of the walls. As a rule, the foot-wall of any particular mass of ore becomes the hanging wall of the next shoot of ore beyond. When the pay rock disappears the granite begins to assume its normal appearance, becoming hard and crystalline, and no clearly defined wall is visible. It is usually observed that one side of the workings is softer than the other. In such a case the ore is found a little farther on by cross-cutting the soft side. Some very high-grade rock has been taken from the several claims of this group, which was crushed in a 2-stamp mill a mile from the mines. The deepest work on these veins is 70 ft. from the surface. Holland & Tingman, of Indio, owners.

*Rosalia Mine* (Quartz).—See Santa Rosa.

*S. S. Mine* (Quartz).—It is 4 miles S. of Virginia Dale, in the Monte Negras region, 55 miles N.E. of Walters Station, and is a new discovery, made during 1894. It has produced some very high-grade ore. T. B. Lyon, of San Bernardino, owner.

*San Diego Mine* (Quartz).—It is a new prospect in the Chuckawalla Mountains, 45 miles N.E. of Salton Station, and 4 miles from Long Tanks. The rock found here is high grade, heavily mineralized and oxidized. Water, though not abundant, occurs in the neighborhood, and the mining facilities are as good as are ever found in this portion of the desert. E. E. Bowles, of San Diego, owner.

*Santa Fe Mine* (Quartz).—It is 5 miles W. of Perris, and has been developed somewhat since our last report, but was not working in 1894, and the tunnels leading into the mine were locked. No data could be obtained about this property. See our VIIIth and XIth Reports, pp. 527 and 385. Phelps, Judson et al., of Pasadena, owners.

*Santa Rosa (Rosalia) Mine* (Quartz).—It is 7 miles W. of Perris, and has recently been reopened after a period of long idleness. Hoisting

and milling machinery has been purchased, and will be put in place before November 1, 1894. The new workings extend to a depth of 200 ft., and expose a 3 ft. vein of quartz of good grade. The mine has been worked to water level, and about 1,000 ft. along the vein, by Mexicans many years ago. See our VIIIth and XIth Reports, pp. 526 and 385. W. H. Griffith, of Perris, Superintendent.

*Stanford Mine (Quartz).*—This is 1 mile S.E. of the Victor. The mine is rather different from those commonly found in this district, being a system of branching and overlapping fissures in a massive eruptive rock. The veins or shoots occur irregularly, and are richest and best defined near the points of intersection of two fissures, or occur in vein-like masses between two nearly parallel fissures. At some points the shoots occur as a zone, being in the form of several vein-like deposits uniting or lying parallel. In such cases the entire mass is gold bearing, and may be mined with profit. The developments consist of a shaft 125 ft. deep, a cross-cut tunnel from the surface, intersecting the shaft at 70 ft., where a drift runs along the vein. A small 5-stamp mill has been erected just below the mine for prospecting purposes. Hearn Bros., of Perris, owners.

*Stanford Mine, Small Prospects Near.*—A number of small prospects are being opened near the Stanford Mine, one or two men being employed on each. The rock is taken to the Huntington mill, which treats custom ores. During the past season prospecting has been carried on through this section, resulting in the discovery of a number of small veins in granite. As a rule, these veins do not hold out in depth, but afford a temporary means of livelihood for the discoverer, and in some instances prove veritable small bonanzas.

*Victor (La Ploma) Mine (Quartz).*—This was idle during the past year. There is a cross-cut tunnel, mostly in hard rock, nearly 1,000 ft. in length. The quartz is hard and crystallized and frequently carries galena. Some of the rock is rich in gold, but the vein is spotted. In appearance it greatly resembles many of the "pocket" veins of Mariposa and Tuolumne counties. See our VIIIth and XIth Reports, pp. 527 and 384.

*Virginia (Shey) Mine (Quartz).*—It is 3 miles W. of Perris. Since our last report this property, then a prospect hole, has been bonded, and considerable development work done. The main shaft is down nearly 200 ft. See our VIIIth and XIth Reports, pp. 526 and 385. Jerry Shey, of Perris, owner.

## SACRAMENTO COUNTY.

In Sacramento County placer and drift mining are carried on in the foothills of the Sierra, and in the slate formation there are a few pocket mines which are said to have yielded very rich ore. In 1878-79, experimental borings were made at Folsom, to prospect the auriferous strata underlying the tufa which constitutes the "bedrock" on which the superficial gold-bearing gravels rest. The formation penetrated by these borings is as follows:

Cobblestones.....	10'
Fine loose gravel, with water.....	6'
Tufa.....	15'
Auriferous white sand.....	5'
Quicksand (water raised in casing).....	7'
Cemented gravel.....	5'
Loose sulphurets.....	3'
Auriferous and cemented gravel.....	50'

E. McCue & Co., bearing in mind the results of these early investigations, are sinking a shaft at Folsom to further prospect the auriferous sands and gravels beneath what was formerly considered to be the "bedrock." Dredging has also been commenced in the bed of the American River at Natoma.

*Amador and Sacramento Canal Company's Mines (Placer).*—These mines are on the south side of the Cosumnes River, at Michigan Bar. They cover an area of about 1,800 acres, and are for the most part situated on patented land. The Columbian Gold Mining Company work the placer claims on the property by hydraulic mining and ground-sluicing. Ten men at work. See Ritter Ditch, under title of Cosumnes Land and Water Company, in our Xth Report, p. 514.

*Burke Mine (Drift).*—It is at Rebel Hill, 3 miles S.W. of Folsom, on the Natoma Grant. The shallow shaft penetrates gravel, clay, and cobblestones for about 55 ft., at which depth there is a stratum of auriferous gravel about  $4\frac{1}{2}$  ft. in thickness, which rests on a bedrock of tufa. The gold is flaky and rusty. Seven men at work.

*Chinese Claims (Drift).*—About 25 Chinamen are engaged in drift mining in the town of Folsom.

*Doc Yen Mine (Placer).*—This claim, on the Natoma Grant, is worked by 13 Chinamen, and is a deep gravel claim; worked by stripping to a depth of 33 ft.

*Doan Mining Dredger.*—In July, 1894, the owners of this machine commenced dredging the bed of the American River at Natoma. Their plant consists of a grab-dredger run by steam power, and having a normal capacity of 500 tons every twenty-four hours; also two 10-inch pumps. The gravel is dumped by the grabber into a 4 by 6 ft. hopper, which is furnished with a screen perforated with 1 in. holes. The coarse gravel is washed from the screen into the river. The fine gravel and sand pass through the screen into sluices, which are provided with riffles and blankets. The scow on which the dredger is erected is 18 by 30 ft. Three men are employed.

*Dorian Mine (Quartz).*—This claim is on patented land, in Sec. 4, T. 8 N., R. 8 E., in the Wall Town Mining District. P. Dorian, of Folsom, owner.

*Eckardt Mine (Placer).*—It is 5 miles E. of Folsom, in Willow Springs District, covers an area of about 20 acres, and is on the Natoma Grant. Eight men at work.

*Eckhardt Mine (Quartz).*—This mine is in Willow Springs Mining District. It is a pocket mine. P. D. Eckhardt, of Folsom, owner.

*Finch Mine (Drift).*—This claim is at Rebel Hill, on the Natoma Grant. Three men at work.

*Folsom Water Power Company's Mining Claim.*—This is situated in the bed of the American River, and, commencing at the dam above the Folsom State Prison, it extends for a distance of about 2 miles down the stream. The officers of this company state that they contemplate turning the water from a portion of the bed of the American River and mining its channel.

*Jordan Mine (Placer).*—This mine is on the north bank of the Cosumnes River, and covers an area of 160 acres. The claim is worked by ground-sluicing. Six men at work. Jas. Jordan, of Michigan Bar, owner.



*Keefe & Mahone Mine* (Placer).—It is on the Natoma Grant, in Willow Springs District, 5 miles E. of Folsom. Five men at work.

*Milgate Mine* (Quartz).—It is on patented land in Wall Town Mining District. This is a pocket mine, which yielded a small amount of very rich ore several years ago. W. Milgate et al., of Sacramento, owners.

*McCue & Co.'s Mine* (Drift).—E. McCue and others are sinking a 4 by 8 ft. shaft to prospect sands and gravels which were worked at an early day at Folsom. In June, 1894, the following formation had been penetrated: Tufa, 53 ft.; auriferous sand, 2 ft. Three men at work McCue & Co., of Folsom, owners.

*Old De Rosa Mine* (Placer).—It is on the Natoma Grant, at Sulky Flat. Four men at work.

*Perry Mine* (Drift).—It is on the Natoma Grant, in Willow Springs District, 5 miles E. of Folsom. Six men are employed.

*Rodger's, Antone, Mine* (Placer).—At Sulky Flat, on the Natoma Grant. Four men at work.

*White & Donnelly Mine* (Drift).—This claim is on the railroad right of way at Folsom. The developments consist of two 45 ft. shafts and many feet of drifts and cross-cuts. From 20 to 25 men are employed. White & Donnelly, of Folsom, lessees.

*Zimmerman Mine* (Quartz).—This is situated on patented land about 5 miles S.E. from Folsom. The developments consist of a 30 ft. shaft.

#### SAN BENITO COUNTY.

*Chalone and Defiance Mines* (Quartz).—These mines are situated on a ridge running N.E. from the South Chalone Peak, at an elevation of 2,200 ft. They are reached by a trail nearly 3 miles long from the lower end of Bear Valley. Gold occurs here in a very unusual manner, seeming to be an original constituent of a body of fine-grained, white liparite. This liparite is found in the center of a much larger area of banded liparite, obsidian, and tufas, which forms the Chalone Peaks and the mountains northward for 6 miles or more, with a width of about  $2\frac{1}{2}$  miles. The body of gold-bearing liparite has an irregular wedge form with its point to the north. On its southern extremity it is about a mile across. The two claims located here are one fourth of a mile apart, on deposits which are apparently wholly independent of each other. No work has yet been done on the Defiance, but on the Chalone, which lies on the north side of the ridge, a tunnel has been run 290 ft. The end of the tunnel will be nearly 400 ft. from the surface when the center of the hill is reached.

A careful examination of the liparite shows it to be uniformly fine-grained and almost white, except where stained with iron. It varies somewhat in texture, portions being very compact, while others are more loose and porous, the spaces not being gas pores, but those left by contraction on cooling. It is very difficult, if not impossible, to distinguish the gold-bearing rock from that in which the mineral has not been detected. In some places where the gold is found the rock is more porous, but this is not always the case. A small amount of manganese is found coating the seams in some places on the surface of the Chalone claim. This was not noticed in the tunnel. None of the many assays made from the material taken out of the tunnel have failed to show

traces of gold. There are no indications of a fissure or crushed zone, and it is difficult to account for the presence of the gold if it is not primary. Many specimens have been found in which the gold is plainly to be seen with the unaided eye. It sometimes occurs on the borders of small cavities with oxide of iron, probably resulting from the decay of iron pyrites, and at others in the white rock. A very little water seeps into the tunnel in places, not more than to make it moist, and though the rock is full of joints, so that it breaks up into small fragments, yet this feature is no more noticeable than in other portions where no traces of gold have been found. The round blotches of iron oxide are to be found over almost the whole area of the white liparite. They are an eighth of an inch or less in diameter, and result from the decay of iron pyrites, the cubical form of which sometimes remains. It was at first supposed that the gold might have been originally combined with the pyrites, but that this was not generally so, is shown by the results of assays made on several portions of the white liparite where the brown stains are the most numerous; no appreciable amount of gold being found. The Chalone claim has a N. and S. course, extending up to the summit of the hill rising from the ridge. Captain Nichols, who is in charge of the work, reports that gold has been found the whole length of the claim, with a greatest width of 200 ft. The area in which gold has been detected on the Defiance claim is said to be quite irregular. Several assays made from the white liparite on the southern and eastern sides of the hill also show traces of gold, proving conclusively its wide distribution. The results of these observations seem to indicate without much doubt that the gold is distributed very generally through the white liparite, though not evenly, and not always in quantities which can be detected with the methods used. The absence of all the usual signs of secondary action in the crushing of the rock or the reddening of the surface very much favors the idea of the primary nature of the gold: that it was disseminated through the molten magma at the time of eruption. Whether it is present in workable quantities or not has not yet been demonstrated. Judging both from the position of the white liparite and the absence of flowage structure, it seems probable that it has simply welled up in the position in which it is found.

#### SAN BERNARDINO COUNTY.

This county has wonderfully diversified mineral resources. There are now in active operation mines of gold, silver, lead, copper, borax, salt, lime, cement, marble, granite, sandstone, and macadam rock. Besides, there are also deposits and veins of iron, tin, zinc, manganese, asbestos, gypsum, baryta, soda, and sulphur. Hot and cold mineral springs are numerous also. Since our last report several new gold fields have come into notice, the most prominent being Shadow Mountain, Goldstone, and Coyote Holes, each of which will in time doubtless add to the wealth of the county. The borax industry, now large, will probably increase in proportions, as new and extensive fields of calcium borate have been discovered. The silver mining industry at Calico is also about to be revived.

*Althea (Embody) Mine (Quartz).*—It is at Oro Grande. See our XIth Report, p. 361. H. Eaton, of Halleck, owner.

*Altura (Altuma) Mine* (Quartz).—This is 3 miles S. of the Rose Mine, and about 15 miles E. of Bear Valley Lake. There is at present no machinery on the mine. A shaft has been sunk 63 ft. on a 3 ft. vein and a drift run 150 ft., from the bottom of which a winze has been carried down on the ore. Wood suitable for fuel is abundant, but water is scarce. Altura Mining and Milling Company, owners; Judge C. E. Otis, of San Bernardino, President.

*Alvord Mine* (Quartz).—It is 23 miles N.E. of Daggett. See our VIIIth and XIth Reports, pp. 499 and 359. Alvord Mining Company, owners; W. U. Masters, of Pasadena, President.

*Bear Valley Region.*—The geology of this portion of the San Bernardino Mountains is very interesting. From the main range of these mountains, the axis of which is E. and W., the entire country is granite to the south side of Bear Valley. Along the spurs extending into Bear Valley from the high hills on the south may be seen remnants of an ancient channel. The wash consists of well-rounded pebbles and cobbles of granite, quartzite, slaty rocks, and some eruptive rocks, all of which are foreign to the immediate neighborhood, excepting the granite. This mass of washed material is bedded in a coarse granitic sand. Panfuls of the cemented wash were "prospected," as was also the concentrated result of natural erosion in some of the near gullies which cut into the deposit, but in no case was gold discovered. The cemented wash is usually covered with a heavy accumulation of angular and sub-angular cobbles, mostly quartzite and finer granitic sand and rock fragments. On the north side of Bear Valley Lake limestone occurs, and farther north quartzite and mica schist, uplifted and fractured by intrusive granite. The metamorphic rocks, consisting of limestone, quartzite, and mica schist (the latter occurs in relatively small amount), are a portion of the series which extends from near Twenty-nine Palms northwest along the northern flanks of the San Bernardino Mountains to West Camp, 12 miles N.W. of Victor, a distance of 85 miles. Remnants of lime formation southeast of Twenty-nine Palms, in the Ophir Mountains, indicate that this lime formation is over 130 miles in length. Along this distance the quartzites appear, being well developed at Oro Grande, about Bear Valley, Holcomb Valley, and eastward as far as Ophir Mountains, which lie south of the Monte Negras and north of Eagle Mountains. Gold, silver, and lead occur along the entire length of this belt. The formation is everywhere much disturbed and shattered. Granitic dikes are thrust into the sedimentary rocks, faulting, crushing, and folding them; dikes of diorite and felsitic and porphyritic rocks also play an important part in this connection. The mines are found where the greatest disturbance seems to have occurred. A notable instance is in the Gold Mountain Mine. A close inspection of quartzite at some distance from any of the so-called ore bodies of this mine showed the frequent occurrence of finely disseminated iron sulphurets. In view of this fact, it appears that the crushing of the quartzite has afforded an opportunity for the decomposition of iron sulphurets in considerable quantity in large masses of the rock and the infiltration of gold-bearing solutions, derived from the normal rock, into those portions best prepared for their reception, by their crushed porous condition, thereby enriching such zones of rock. That all, or nearly all, the mineral-stained quartzite contains gold in small quantity there is little doubt. At Silver Reef, near the lower end of Texas Cañon, the quartzite contains, besides gold



and silver, sulphides of iron, lead, zinc, and copper. In the region about the Rose Mine the limestone carries chiefly gold; at Oro Grande the ores in the limestone are lead, silver, and gold, no deposits of either gold, silver, or lead having as yet been discovered in the quartzite in that district, though the indications for finding gold-bearing deposits similar to those of the Gold Mountain are promising.

*Black Hawk Group of Mines (Quartz).*—They lie 40 miles S.E. of Victor, and embrace the Lookout and Santa Fe. They all lie on the north slope of the Black Hawk Mountains, in a series of benches or terraces, the result of several faults, having an easterly and westerly trend. The entire region for miles is greatly disturbed by faults, of which there are several series. In Black Hawk Cañon, gneissoid rocks and crystalline limestone are found overlying beds of sand and cobbles, which have every appearance of having been formed recently, and bear a marked resemblance to the loosely cemented sandstone and conglomerate near the Cajon Pass. The local disturbances are numerous, and the whole region offers a field of interesting study to the student of structural and dynamic geology. During the fall of 1894, preparations were in progress to sluice the dumps of the Lookout Mine, and an arrastra was being built to crush rich rock from the Santa Fe. See our Xth and XIth Reports, pp. 524 and 364. Cook, Leach & Co., of Victor, owners.

*Boomerang Mine (Quartz).*—This is  $2\frac{1}{2}$  miles W. of Vanderbilt, and is one of a group of seventeen claims. The principal development and apparently the largest and best defined crevice and ore shoots are on the Boomerang claim. The fissure strikes N.  $55^{\circ}$  W., and is opened to a depth of nearly 400 ft. Near the main shaft a branch extends to the eastward at an angle of  $20^{\circ}$  with the main vein. This crevice has produced some high-grade rock. On the southwest side of the Boomerang vein is another vein nearly parallel with it, but probably a part of the same system. There are several small veins on the west side, none of which are developed sufficiently to make it possible to say much about them. The Boomerang vein differs quite materially from the other veins of the district, as the ore occurs in a dike of light-gray rock of fine texture. This dike is from 1 to 15 ft. wide. It is fractured, as far as exposed, by a system of nearly parallel fissures. Between these the dike rock is crushed and pulverized to a greater or less extent, and in these shattered portions of the dike the ore shoots have been deposited, the amount of ore and quartz appearing to be directly proportional to the amount of crushing sustained by the dike rock previous to the infiltration of the ore-bearing solutions. Southward from the main shaft is a shoot of ore 5 ft. wide, which farther southeast divides into two veins, each less than a foot wide. Along this portion of the mine the dike is broad, but farther south it becomes narrower, and at the face of the southeast drift has dwindled to 1 ft., with the pay shoot lying on one side of it, the quartz being but 4 in. in width. A vein-like mass of low-grade quartz appears here on the foot-wall side, which can be traced for hundreds of feet southeasterly on the surface. This portion of the mine is entirely undeveloped. The Boomerang Mine has a 10-stamp mill. The main shaft has now about reached the level of the valley, 350 ft. below, and water is coming in, and the probability is that the flow will be largely increased with additional depth. See Vanderbilt District, also XIth Report, p. 367. Green Campbell, of Vanderbilt, owner.

*Burnap Mines (Quartz).*—These are in Upper Holcomb Valley. The veins consist of several small fissures in the granite, on which some superficial work has been done. In one place a shaft was sunk to a depth of 40 ft., and a vein of gold-bearing quartz, carrying iron sulphurets, exposed. Half a mile up the gulch there are several small holes, exposing a quartz vein carrying a large amount of hard limonite ore. This is supposed to be the vein from which came the enormously rich iron "float" found in the placers of the region; but though the quartz and iron of the vein carries gold, no rock approaching in richness that found in the placers has thus far been discovered. J. Burnap, of Los Angeles, owner.

*Center (Livingston) Mine (Quartz).*—It is 4 miles E. of the Rose Mine. It is now equipped with horse and gasoline hoists and a 10-stamp mill. There are two inclines on the mine, each about 200 ft. deep; there are several surface cuts, all of which expose gold-bearing quartz. The west incline is on a narrow and extremely irregular quartz vein, ranging from a seam to nearly a foot in width; the narrow portions of this vein are very rich, and the work thus far done has been at a profit. This fissure cuts the formation (a rather massive, micaceous, and hornblendic schist) in both strike and dip at a low angle. In the neighborhood both quartzite and limestone were observed on the surface, neither of which has been encountered in the mine. The developments of the east portion of the mine show a zone-like mass of quartz and mica schist 10 ft. wide. Within the zone is an irregular, apparently independent vein-like streak of quartz, which is heavily mineralized and much richer than the zone of gold rock in which it occurs. Morongo King Mining Company, of San Bernardino, owners; C. W. Allen, President.

*Chippy Mine (Quartz).*—It is in Vanderbilt District, and embraces four distinct veins, which converge in the direction of the Queen of Night shaft. These several veins are smaller than those in the Gold Bar and Gold Bronze mines, and the crevices are not as well defined, but the average of the ore is richer than that found in the others. See Vanderbilt District, also our XIth Report, p. 367. J. P. Taggart, of Vanderbilt, owner.

*Christie Mine (Quartz).*—This is at the head of Lone Valley, and is the first extension west of the Rose Mine. The shaft is 193 ft. deep. A drift from the bottom of the 165 ft. shaft encountered a body of rich ore, which there is every reason to believe is on the succession of shoots occurring farther east in the Rose Mine. The property is as yet without a mill. E. Pratt, of Glendora, owner.

*Coyote Holes.*—In the latter part of August, 1894, a discovery of gold-bearing veins was made in the metamorphic rocks N.E. of Calico, near Coyote Holes. A number of prospectors immediately went there and located the entire district. The gold occurs in a decomposed, "honey-combed" quartz rock.

*Eastern Districts.*—In the eastern portion of San Bernardino County there are a number of mining districts, some of which have been known for many years. The principal ones are *Vanderbilt*; *Ivanpah*, 23 miles N.W. of Vanderbilt; *Shadow Mountain*, 55 miles N.W. of Vanderbilt; *Providence Mountain*; *New York*; *Ibex*; *Gold Stone*, and *Exchequer*, near Homer Station, on the line of the A. & P. R. R.

*Gold Bar Mine (Quartz).*—This is at Vanderbilt, and has a strike N. 63° W., dipping 80° to 85° N.E. The crevice is clean and well defined,

having heavy gouge matter and masses of clay. A dike rock much decomposed accompanies the fissure. The ore forms in shoots in the shattered and crushed portions of the crevice. In some places two distinct veins of ore were observed. The ore shoots have a persistent habit of overlapping both in depth and longitudinally. On one level drifting westward the vein pinches, leaving a barren crevice. A cross-cut into the hanging-wall discovered the vein on that side of the crevice. A notable fact in this connection is that at the place where the ore disappeared and the overlap occurred the hanging-wall was very soft and spalled off in great slabs of clay-like material, clearly showing the tremendous movement and pressure that had occurred at that point. The clay was filled with small angular fragments of quartz and blotches of ore. In fact, there was every indication that the ore might be found in the hanging-wall. In sinking the main shaft a similar occurrence was noticed. The shoot pinched, leaving the crevice well defined but without ore. A few feet farther the ore reappeared on the foot-wall side. There are two shoots of ore now exposed in this mine, which appear to average  $2\frac{1}{2}$  ft. in width. It has the appearance of being a fissure of great depth. See Vanderbilt District, also our XIth Report, p. 376. St. George Mining Company, Mackay, Flood & Lyle, of San Francisco, owners.

*Gold Bronze Mine (Quartz).*—See Vanderbilt District. This is practically the same as the Gold Bar fissure, and resembles the latter in many of its features, though the crevice is not as sharply marked and is rather smaller. There are two shoots of ore, which were developed to a depth of 180 ft. in May, 1894. The shaft is being sunk deeper at this writing. The difference in the two fissures is probably due to the fact that in the Gold Bronze claim the main fissure has divided into four or more distinct crevices, but with greater depth these will probably unite and form a vein as wide and as clearly defined as that in the Gold Bar. This mine is equipped with a steam hoist and 10-stamp mill. See our XIth Report, p. 367. Gold Bronze Mining Company, of Vanderbilt, owners.

*Gold Mountain Mine (Quartz).*—It is 7 miles N.E. of Bear Valley Lake, on a quartzite mountain overlooking the Mojave Desert. The quartzite is greatly shattered and in some places crushed and pulverized. In those portions which have sustained the greatest amount of crushing, bodies of massive quartz of irregular shape and size have formed, and it is these portions that contain the greatest amount of gold. The 40-stamp mill was burned, since which time nothing was done until 1893, when an experimental mill was built. This was abandoned after a short trial. It is rumored that operations on a large scale are to be resumed. E. J. Baldwin, of San Francisco, owner.

*Gold Placers* were discovered in May, 1894, in the low desert hills 3 or 4 miles N. of Ord Mountain. Two men were at work here prospecting the small ravines and depressions with a dry washer. The result, judging from the frequent change from place to place, was not all that could be desired. The occurrence of a mass of red conglomerate near the washes where the gold was obtained, suggested the possibility that the gold might have come from that source. The material was "prospected" in several places, but gave no trace of gold.

*Gold Stone District* lies in the Providence range of mountains, 35 miles N.W. of Fenner Station. Some extremely rich gold quartz was



found in this district in May, 1894. Two men were at work on the claim at the time.

*Holcomb Valley District.*—It is 4 miles N. of Bear Valley Lake, and has long been known as a placer region. See our Xth Report, p. 523.

*Holcomb Valley Company* (Limited) owns in Holcomb Valley a large tract of placer ground, which, after several unsuccessful attempts to work, they are now sluicing on quite an extensive scale, employing a steam shovel, a separating machine, and elevators, the latter being used to dispose of the coarser tailings. The gold-bearing material is not "gravel" in the ordinary sense of the term, but a coarse, angular, granitic detritus, containing very few washed or rounded stones. The material is mostly small. Occasionally cobbles occur, but these are exceptional. The gravel is overlaid by 4 to 8 ft. of light, loamy material, while the substratum contains more clay and is also richer in gold. The ponderous steam shovel is mounted on a car quite similar to an ordinary flat car, and is moved backward and forward as required, on a track built on a crib of timbers. The machine is advanced toward the bank of alluvial from time to time; it takes up about a cubic yard of gravel and sometimes more, at each load, and dumps it into a hopper, which, by means of a feeder, discharges into a revolving screen. This causes a separation of coarse and fine material. The coarse pebbles and cobbles pass through the screen and are taken up by the buckets of an endless elevator, which delivers them to a second belt elevator, so arranged as to deposit the tailings on the bank of the cut 30 ft. distant. The fine material passing the meshes of the rotary screen drops into the sluice-box beneath, and is carried by a stream of water over the riffles and blankets. The fine tailings are conducted through a half-round steel flume, from the foot of which they are shoveled out of the tail-race by hand. The capacity of the plant is from 1,000 to 2,000 yds. per day, depending on the water supply, which, during the past season, was very low. The management expressed considerable satisfaction at the operation of this plant, as it is the only means thus far employed which assured success to their undertaking. *Holcomb Valley Company* (Limited), of London, owners; W. E. Pedley, of Victor, Superintendent.

*Holcomb Valley Mining Company* (Placer).—They own a tract of placer ground near the head of Upper Holcomb Valley. During June, 1894, a shaft was sunk, and a large quantity of water was encountered, but it was hoped that by continued pumping bedrock could be reached. It is said that a large amount of coarse gold has been taken from the upper part of the valley. *Holcomb Valley Mining Company*, of Los Angeles, owners; J. Burnap, of Los Angeles, Superintendent.

*Ibex Mine* (Quartz).—It is 3 miles S. of the A. & P. R. R., and 11 miles N. from The Needles. (Not to be confounded with the Ibex Mine, near Death Valley.) A mill was built in the spring of 1894. Permission could not be obtained to investigate the mine, consequently nothing definite is known of its workings or character. See our XIth Report, p. 368. *Ibex Mining Company*, owners; Chas. A. Marriner, corner First and Broadway, Los Angeles, Superintendent.

*Lytle Creek* (Placer).—The mines of Lytle Creek, which for years had been worked in a desultory manner, became the scene of active operations during the summer of 1894. In June no less than 50 men were at work along the stream, and this number was augmented almost daily

by new arrivals, until upwards of 100 men, mostly working independently, were engaged in gold washing. Four miles above the old Texas Hill Mines hydraulicking was carried on in a small way, and it was generally believed that all the mines engaged in sluicing, rocking, and hydraulicking were doing well, though all were reticent as to the amount of gold actually being produced. These placers extend from near the mouth of the Lytle Creek Cañon to its headwaters on the slopes of San Antonio Peak. Quartz veins, bearing gold, are located in many places along the cañon, and on these more or less work has been done, but none of them are in active operation.

*Morongo King Mining Company* (Quartz).—See Center (Livingston) Mine, and our Xth Report, p. 526.

*Morongo Mine* (Quartz).—See our VIIIth Report.

*Morongo Mining Company* (Quartz).—See Rose Mine, and our IXth Report, p. 226.

*Old Woman's Springs*.—In July and August, 1894, there was much interest manifested in the reported discovery that the scoriaceous basalt at Old Woman's Springs was gold bearing, and numerous claims were located. The amount of development work, however, was small, and though the claim owners professed to believe the lava rich in gold, few of them gave practical evidence of their good faith.

*Ord Mountain District* contains several large mineral deposits, some of which assume a vein-like form. In each the veins consist of silicious impregnations, with iron and copper sulphurets, oxidized at the surface, gold occurring in greater or less quantity. The veins have in every instance formed along a zone of crushed diorite, showing distinct overlaps and a branching tendency. The principal vein is plainly defined for a long distance on the surface. Several hundred feet of development shows clearly the geological features of the vein, which varies in width from 1 to 8 ft. None of the mines were being worked during the past year. See our IXth and Xth Reports, pp. 222, 226, 528. J. B. Osborne, of Daggett, owner.

*Osborne Placers*.—They are in the middle portion of Upper Holcomb Valley. J. B. Osborne, of Daggett, owner.

*Rose Mine* (Quartz).—It is 65 miles N.E. of San Bernardino, and about 15 miles E. of the Bear Valley reservoir. The mine is equipped with a 5-stamp mill and grinding-pan. Geologically the mine is an unusual one, consisting of a succession of ore shoots or chambers along a line of fracture which extends E. and W., dipping about 45° N. The fissure cuts at a small angle through crystalline limestone, quartzite, and a mica schist, being usually accompanied by a dike of granitic rock, which is never absent where an ore body is found. The ore bodies occur in regular form and size, and are chiefly a mixture of quartz and calcite, with a varying but usually a large amount of scaly hematite (sometimes containing as much as 45 per cent of iron). The gold occurs in a greater or less amount, depending on the proportion of iron. Heavy hematite ore has been shipped in considerable quantity, containing \$200 to \$500 per ton in gold. Owing to the fact that the gold appears to be covered with a film of iron oxide, a simple sampling of the ore has not been found sufficient to render the particles easily susceptible to amalgamation, and a subsequent grinding of the tailings has been resorted to, with good results. During the month of July, 1894, a large quantity of tailings was being ground a second time. The

main incline, at some distance from the surface, passes from the fissure into the hanging-wall. This shaft is sunk at a point where the series of ore chambers reach the surface. As depth is attained, the ore passes to the west, and at the bottom of the shaft, 450 ft. in depth, the ore lies nearly 300 ft. W. The lower western portion of the mines was being diligently prospected in July, 1894, for new ore bodies, with very favorable indications of the close proximity to a "shoot." That portion of the property lying east of the main shaft, while not neglected, has received comparatively little attention, and the existence of an ore body in that direction remains to be determined. No considerable amount of cross-cutting has been done, though the appearance of the "ground" in many places suggests the advisability of such a course. The high grade of the ore and its unusual geological features have attracted much attention, and have been an incentive to a large amount of prospecting in the vicinity. See our IXth Report, p. 226. The Morongo Mining Company, of Riverside, owners.

*Sidewinder Mine* (Gold and Lead).—It is 14 miles N.E. of Oro Grande, and is being worked by a small force and the ore shipped to smelting works. It contains some lead, but is practically a "dry" gold ore. See our Xth Report, p. 527. Joseph Driscoll, of Oro Grande, owner.

*Upper Holcomb Valley* is half a mile east of Holcomb Valley, and has long been known as a placer region. In neither this valley nor Holcomb Valley proper is water for placer mining abundant, nor is the slope of either valley sufficient to afford good dumpage. Drain tunnels have been projected several times, but none of them have been undertaken. As the area of ground to be worked in either case is small, it is a question whether the amount of gold which may be obtained from such operation would justify a lengthy drain tunnel. See our Xth Report, p. 523.

*Vanderbilt District*.—It is 4 miles by wagon road from the present northern terminus of the Nevada Southern Railroad at Manvel, being situated among the hills which form the northeastern end of the New York Mountains, which are a portion of the Providence range. The geology of the district is quite simple. The rocks of the region are chiefly gneissoid and schistose granitic and hornblende rocks, with large masses of the variety of granite called pegmatite, which in some parts has exceptionally coarse crystallization, containing a large amount of rose-colored orthoclase and very little mica. In fact, the almost total absence of mica of any variety from these rocks is a noticeable feature. Later intrusive dikes of a variety of rocks of granitic type, between felstone and aplite, occur throughout the region, but not abundantly. These dike-like masses are found accompanying all of the principal fissures, though also occurring where no ore channels are found.

The strike of the country rocks, over an area of 20 square miles of this region, is almost uniformly N. and S., the dip varying, but usually nearly perpendicular. The eastern borders appear to become more gneissoid, and contain more hornblende rocks than the section immediately about the village, and westerly is found a belt of limestone, beyond which occurs syenitic granite of normal type. Large dikes of rhyolite and vitrophyre occur in these western granites, and ferruginous quartz veins also, which contain some gold, but are usually low grade and not of a



character to excite much attention; still farther westward the quartz veins are very large and are stained with copper carbonate.

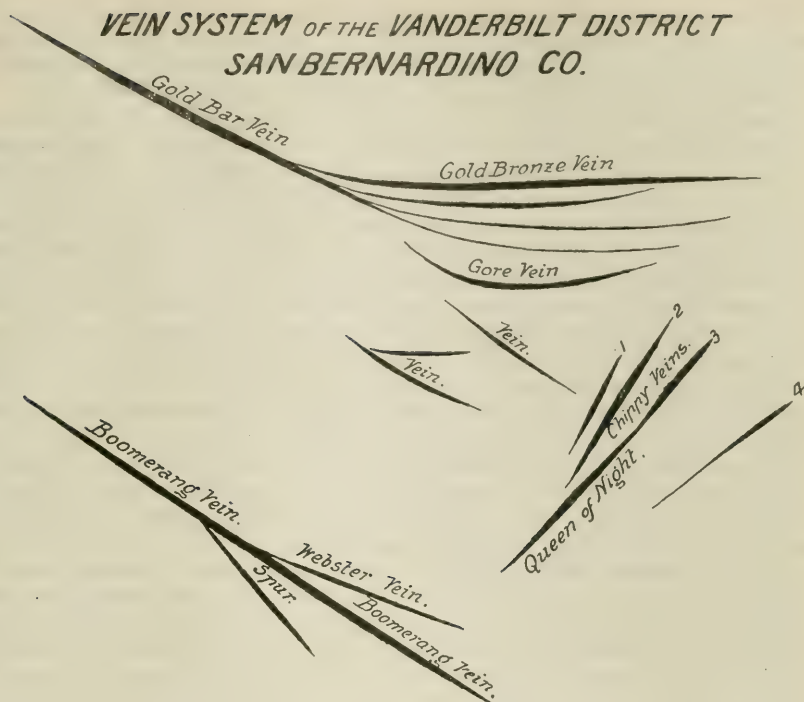
These highly metamorphic schists and granites are doubtless partly metamorphic, as indicated by the occurrence of limestone, but the greater portion of the pegmatite granite, as well as the more recent felstone, is eruptive. All about the eastern and southern borders of this district the rocks are overlaid by heavy accumulations of rhyolite, tufa, and scoriaceous lavas, which are piled up to a height of nearly 1,000 ft., though doubtless greatly denuded. The successive flows are clearly denoted in the terrace-like appearance of the cliffs. White tufas form the base of the series. The rhyolites are of several types, and form an interesting petrographical study. These rocks dip away from this region in a southeasterly direction, and have no apparent connection with the mineral veins of the district. They resemble the liparites of Calico, but no ores have, as yet, been found in them.

*The Vein System of the Vanderbilt District* forms one of those peculiar studies in dynamic geology which this interesting desert region so frequently affords. The first impression of the visitor is that the veins are scattered indiscriminately, without apparent relation to each other. A closer observation, however, shows that they are grouped in systems, have direct relations, and are all due to common causes, viz.: The fissuring of the rocks by what appears to have been a compound stress of opposing forces; the injection of dikes along many of the planes of weakness thus formed; a subsequent movement of the rocks, and later, the deposition of ores in these fissures. Subsequent to the formation of the ore shoots these fissures have been subjected to further movement, resulting in a crushing of the ore and quartz and the formation of striated planes and selvages of clay. Cross-fissures (faults) also occur, which in some cases appear to have either displaced the veins, as in the east end of the Gold Bronze Mine, or have had a direct influence on ore deposition, retarding it, as in the northwestern end of the Gold Bar and Boomerang mines.

There are two chief systems of fissures in this district—the Gold Bar system lying on the east side of the area of veins, and the Boomerang system on the west. The Gold Bar fissure is the most pronounced and sharply defined crevice in the district. Beginning at its northern end, it strikes S. 63° E. for 1,200 ft., where it sends out a branch, which sweeps around to the eastward, forming the Gold Bronze fissure, striking due E. and W. Beyond the point of divergence the main fissure continues southeasterly, sending out branch after branch. At least four others have been determined, all of which curve around to the east. There is no doubt but that these veins reunite with the Gold Bronze vein in depth. The insufficient development affords no safe guide to this.

The Boomerang system lies 1,000 ft. to the westward, and the main crevice strikes N. 55° W. It also sends off branches in going southward, though they are fewer in number than on the opposite side of the ridge. The principal one of these has a strike S. 70° E. A peculiarity of these two vein systems is that nearly all the branches are to the south and east.

A third system occurs between the two systems described, in which the main crevice (in Chippy Mine) strikes N. 30° E., and to the southward another crevice striking N. 45° E. A shaft on the east end of this



claim is on a vein striking N. 50° E. It will be noticed that all of these veins converge toward the west, and would unite, if their respective courses continued as observed, near the Queen of Night shaft, where the vein strikes N. 45° E.

Besides the three systems here described, there are several small veins on which little has been done or where the development exposes crevices so small as to make any particular statement concerning them valueless.

The future prosperity of the district lies largely with the mine owners themselves. The fissures have every indication of being deep, and are usually well defined. The ores can be worked to the best advantage by amalgamation on plates and concentration of the sulphurets on vanners and canvas tables. A lack of water, which at present is a material detriment, will be overcome with greater depth of the workings. The "Gilpin County," Colorado, stamp mill on the Gold Bronze Mine, with a 16 in. drop 30 times per minute, and a "bumping table" for a concentrator, does not appear to give the most satisfactory results.

#### SAN DIEGO COUNTY.

Mining operations throughout the county show increasing activity, both in the search for new deposits and in the revival of those long dormant. Aside from the opening up of large new mines such as the Golden Cross in the Cargo Muchacho District, and smaller ones in Pine Valley and Mesa Grande districts, we find over twenty mines in operation in the Julian District, where two years ago there were but three.

The desultory method of prospecting in the Colorado Desert continues, and the introduction of the gasoline engine has solved the fuel problem in a great measure. Large granite quarries are in successful operation around Fosters, near the Cuyamaca Railroad.

*Antelope Mine* (Quartz).—It is 2 miles N.E. of Julian, on the Banner grade. Working. See our XIth Report, p. 380. Bailey Bros., owners.

*Bay View Mine* (Quartz).—It is in the Pine Valley District, 9 miles E. of Descanso, and 9 miles S.E. of the Stonewall Mine. The mine is one of the *Noble group*, comprising the *Bay View*, *Eureka*, *Oxide*, and *Spring* claims. In the Eureka claim is a second vein, called the *Treasury*. This group has made an interesting record. They were discovered by one of the present owners about six years ago, when their means were too limited to provide anything better than an arrastra. To-day there are about 1,000 ft. of cuttings, consisting of shafts, drifts, cross-cuts, and surface workings, exposing veins from 1 to 6 ft. wide. The mines within the past five years have paid for all the developments, and realized besides a handsome net sum. The small mill is run with a Knight waterwheel. The mines are little talked of and not frequently visited, but are evidently possessed of more merit than is generally credited to them. See our IXth, Xth, and XIth Reports, pp. 141, 544, and 382. Noble & Sons, of Descanso, owners.

To the eastward of Pine Valley, and extending south toward Buckman's Springs, are several large veins of quartz. No workings were observed, and it is probable that no gold has ever been found in them.

*Black Eagle Mine* (Quartz).—It is in the Mesa Grande District, 10 miles N. of the Santa Ysabel ranch, which is on the stage road between San Diego and Julian. There are several small gold mines in the district, which geologically resemble those between Julian and Banner, and are on the same belt. The principal locations are the *Shenandoah*, *Wildcat*, *Gold Cliff*, *Black Eagle*, *June*, and *Blood Pudding*, all of which, excepting the latter, are owned or under bond to the Shenandoah Mining Company. The Shenandoah Mine is equipped with a 5-stamp mill; all operations are conducted on a small scale. None of the mines are deep, and as admission to any of them was refused by the management, nothing further can be said of them. See our XIth Report, p. 382. J. B. Debney, of Mesa Grande, Superintendent.

*Blood Pudding Mine* (Quartz).—See Black Eagle.

*Blossom Mine* (Quartz).—It is in the Cargo Muchacho District, 4 miles E. of Ogilby Station, and is equipped with a mill.

*California Picacho Mine* (Placer-Hydraulic).—Consists of a large tract of gold-bearing gravel on the west side of the Colorado River, 27 miles from Yuma by trail and 50 miles above the town by river. It is said that \$240,000 have been sent here by an English company in pumps, flumes, and development, but in May, 1894, the enterprise looked very much like a failure. Twenty men were at work on a system of leases, but the extensive operations formerly contemplated did not materialize. Too low a pressure to do effective work, and insufficient grade for dump, are apparently largely the cause of the failure. Allan T. Smith, of Yuma, A. T., Superintendent.

*Cargo Muchacho District*.—It is in the S.E. corner of the county, and has been known for many years, and in the past has produced a large amount of gold. There are two corporations now operating in the district, one the Paymaster Company, lessees of the *Cargo Muchacho Mine*;



the other, the Golden Cross Mining Company, working what was formerly known as the *Gold Rock Mines*. Besides these, there are the *Blossom*, the *Pasadena*, and *Mother Lode* mines.

*Cargo Muchacho Mine* (Quartz).—It is 4 miles from Ogilby Station, on the S. P. R. R., and 16 miles from Yuma, A. T. The vein strikes N. and dips  $45^{\circ}$  to  $60^{\circ}$  E. The country rock is a crystalline hornblendic rock, having a gneissoid structure. The vein is from 1 to 5 ft. in width ordinarily, but in a few places is more than 8 ft. The main shaft is 550 ft. deep. A shaft south of this is 200 ft. deep. Between the 350 and 450 ft. levels, a fault pitching about  $20^{\circ}$  E. has thrown the vein. The indications are that the downward continuation of the main vein lies west of the shaft. Cross-cuts to the east have exposed two other veins lying nearly parallel, which for some months past have furnished the chief supply of quartz. These veins have a somewhat different appearance from the main fissure, being feldspathic and of lower grade. A second nearly perpendicular fault occurs in this mine several hundred feet north of the main shaft, striking across the vein. North of it no quartz has been found in the workings. A gulch on the surface appears to mark the line of this fault. The property is leased by the Paymaster Company. A 20-stamp mill has been constructed at the mine from the machinery formerly in the Paymaster mill and the mill at El Rio. Water in the district is very scarce, and to supply this a pipe-line 12 miles in length has been laid from the Colorado River to the mine. The expense is from \$12 to \$15 per day, the water being raised 300 ft. The tailings are settled and the water pumped to a tank above the mill, to be reused, it being cheaper than to pump the entire amount required from the river. Heavy woolen blankets are laid in the sluices below the copper apron plates. The concentrates are largely limonite and magnetite, and a very small percentage of sulphurets. These are ground and then amalgamated in an iron revolving barrel. The premises and portions of the mine are lighted by electricity. Small electric motors are employed to drive ventilating fans, and on one level an electric hoist is used to raise rock from a winze. Although the lowest portion of this mine is 550 ft. below the surface and 200 ft. lower than the Colorado River, it is perfectly dry. Paymaster Mining Company, of Yuma, A. T., lessees.

*Chaparral Mine* (Quartz).—This is in the Julian District, on the Banner grade,  $2\frac{1}{2}$  miles from Julian. Working. W. W. Boswell, of Banner, owner.

*Chief of the Hills Mine* (Quartz).—It is in the Dulzura District, 30 miles E. of San Diego. See our XIth Report, p. 382. M. O'Reilly, of San Diego, owner.

*Cincinnati Belle Mine* (Quartz).—This is also in the Julian District, half a mile N.W. of Banner, Cal. See our XIth Report, p. 380. Gold King Mining Company, of Pomona, Cal., owners.

*Cravath Mine* (Quartz).—It is 2 miles S.E. of Escondido. Idle. See our VIIIth and IXth Reports, pp. 524 and 382. Gus. Cravath, of Escondido, owner.

*Dulzura Mining District*.—It is 30 miles E. of San Diego. See our XIth Report, p. 382.

*Ella Mine* (Quartz).—It is in the Indian District, 2 miles N. of Julian. The mine, though one of the oldest in the district, has recently come into prominence by the new developments, which expose several veins

of gold-bearing quartz. The rock from this mine is similar to that found throughout the district: a rather pellucid, semi-granular quartz rock, containing innumerable small black, needle-like inclusions, disseminated iron sulphurets, and gold. The walls are mica schist, much shattered and decomposed. The country in the immediate vicinity is intruded by numerous dikes of coarse granite. The quartz is quite rich, and in places gold may be seen in the granite itself. There are heavy gouges on the walls of this mine, which appear to be due to movements which have taken place since the formation of the vein. The vein quartz is much shattered, and tends to corroborate this idea. About 100 tons of quartz were on the dump awaiting transportation to mill. In operation. See our VIth Report, p. 85. S. N. Wilcox, of Julian, owner.

*Escondido Mine (Quartz).*—It is 2 miles E. of Escondido. After a period of idleness preparations were being made in August, 1894, to resume operations on this property. See our VIIIth and IXth Reports, pp. 524 and 382. G. W. Fredericks, of Escondido, Superintendent.

*Eureka Mine (Quartz).*—See Bay View.

*Gold Cliff Mine (Quartz).*—See Black Eagle.

*Golden Chariot Mine (Quartz).*—Situated in the Julian District, 6 miles S.E. of Banner. See our VIth and IXth Reports, pp. 86 and 147. Pacific Bank, of San Francisco, owners.

*Golden Cross Mining Company.*—They own a large group of claims in the Cargo Muchacho District, 6 miles N.E. of Ogilby Station, on the S. P. R. R. The principal claims are the *Golden Cross*, *Golden Crown*, and *Queen*. These were formerly known as the Gold Rock Mines. They are all similar geologically, and constitute a remarkable group. The gold-bearing rock is in no sense a vein, nor can it be considered as deposits of ore replacing country rock. The gold occurs in a country rock, which appears to be a silicious hornblende schist, though the schistose structure is not very distinct in the gold-bearing portion. Large amounts of epidote occur, as a result of the alteration of the hornblende. They are technically bedded deposits similar to those found in the southern portion of the Black Hills, S. D. The deposits are intruded by large and small dikes and irregular masses of granite, and are overlaid by strata which greatly resemble the gold-bearing rock, excepting that the former contain a great deal of feldspar, which, being kaolinized, gives the rock a hard, dry appearance. There are several of these strata containing gold, ranging from 15 to 40 ft. in thickness, and at one point a vertical shaft passes through 90 ft. of rock containing gold. The longitudinal extent of the gold-bearing formation has not been determined. In June, 1894, the main incline had reached a depth of 350 ft. Several displacements of 15 to 20 ft. were exposed in the workings. The company has a 40-stamp mill, in which 100 tons of rock are crushed daily. Water is supplied by a pipe-line from the Colorado River, 12 miles distant, at a cost of \$18 to \$22 per day, the quantity of water varying from 100,000 to 125,000 gallons daily. The water is raised 500 ft. In constructing the mill the mistake was made of placing it on a low flat, in the endeavor to have a site from which all the mines would be easily accessible. Though in operation but a few months, elevators are constantly employed raising tailings to a point where they will flow away from the mill. The pile of sand is already 10 ft. high, and has encroached upon the mill to such an extent that it became necessary to construct a bulkhead. There are several sites in the immediate vicinity where rock foundation and

abundant dump can be secured. Golden Cross Mining Company, owners; T. S. Fuller, of Hedges, Secretary.

*Golden Cross Mine* (Quartz).—See Golden Cross Mining Company.

*Golden Queen Mine* (Quartz).—See Golden Cross Mining Company.

*Gold King Mine* (Quartz).—It is in the Julian District, 4 miles S. of Banner. See our VIIIth, IXth, Xth, and XIth Reports, pp. 513, 143, 543, and 381. Gold King Mining Company, of Pomona, owners.

*Gold Queen Mine* (Quartz).—This is also in the Julian District, 4 miles S. of Banner. See our VIIIth, IXth, Xth, and XIth Reports, pp. 513, 143, 543, and 381. Gold King Mining Company, of Pomona, owners.

*Gold Rock Mines* (Quartz).—See Golden Cross Mine.

*Gold Rock Mine* (Quartz).—See Black Eagle.

*Helvetia Mine* (Quartz).—It is in the Julian District,  $1\frac{1}{2}$  miles E. of Julian, and has lately passed into possession of a Los Angeles company, and all energies are being directed to its development. See our IXth, Xth, and XIth Reports, pp. 145, 542, and 376. E. W. Reed, of Julian, Superintendent.

*Hidden Treasure Mine* (Quartz).—This is in the Julian District, on the Banner grade. Working. Bailey Bros., of Banner, owners.

*High Peak Mine* (Quartz).—It is in the town of Julian. Working. See our Xth Report, p. 542. Horace Wilcox, of Julian, owner.

*Hubbard Mine* (Quartz).—It is at Banner, in the Julian District. Working. See our VIth and XIth Reports, pp. 87 and 380. Bailey Bros., of Banner, owners.

*Jaynes' Mine* (Quartz).—This property is 55 miles above Yuma, on the Colorado River, 5 miles above the Picacho Placer Mines. There is a 20-stamp mill connected with the mine. The vein is large. The workings have reached a depth of 200 ft. Dr. Jaynes, of Philadelphia, Penn., owner.

*Johnston's Mines* (Quartz).—They are in the Dulzura District, 30 miles E. of San Diego. Development work only is done. See our XIth Report, p. 382. — Johnston, of Dulzura, owner.

*Julian Mining District*.—This includes the mines at Banner and vicinity, among which are: Antelope, Chaparral, Cincinnati Belle, Ella, Gold Rock, Helvetia, Hidden Treasure, High Peak, Hubbard, Kentuck S., Lucky Ben, Madden, Neptune, Ready Relief, Redman, Ruby, South Hubbard, Warlock, Washington, and Wilcox. The district was found to be in a more prosperous condition in 1894 than for some years previous, and there is reason to believe that this new era is one likely to continue for some time, and to increase in importance as well. A system of leasing has been inaugurated, by means of which many small mines may be operated successfully and inexpensively. In 1892 there were but three mines in active operation in the district. In 1894 twenty mines were being actively exploited, with encouraging results, and negotiations for the leasing of several other properties were pending in July. Over 50 men are employed on the lease system. The quartz is crushed in custom mills at \$3 per ton. Usually not less than 10 tons are sent to the mill at one time, unless the rock is very rich, which is not an uncommon thing in this district.

*June Mine* (Quartz).—See Black Eagle.

*Kentuck S. Mine* (Quartz).—It is in the Julian District, half a mile from Banner, on the road to Julian. Working. See our Xth and XIth Reports, pp. 542 and 380. N. Bailey, of Spencer Valley, owner.



*Lucky Ben Mine* (Quartz).—It is in the Julian District, near Banner. Working. Boswell & Walker, of Banner, owners.

*Madden Mine* (Quartz).—It is in the Julian District, 1 mile N.W. of Banner. Working. See our VIth Report, p. 86. Charles Bacon, of Banner, owner.

*Mesa Grande District*.—It is situated about 10 miles N. of Santa Ysabel P. O., on the Santa Ysabel ranch, which is on the road between San Diego and Julian. See our XIth Report, p. 382.

*Mother Lode Mine* (Quartz).—It is in the Cargo Muchacho District,  $4\frac{1}{2}$  miles E. of Ogilby Station, on the S. P. R. R. It is the first extension south of the Pasadena. It is being developed with a small force, and has a Huntington mill. See our XIth Report, p. 386. Dr. Mathison, of Ogilby, owner.

*Neptune Mine* (Quartz).—This is in the Julian District, near Banner. Working. W. W. Boswell, of Banner, owner.

*Noble's Mines* (Quartz).—See Bay View Mine.

*Oro Fino Mine* (Quartz).—It is 2 miles S.E. of Escondido, on the farm of F. H. Roberts. It was discovered in the spring of 1894. An incline shaft has been sunk on the vein to a depth of 40 ft. and a drift cut south along the vein. The quartz varies from 2 to 10 in. in width. The country rock is granite, much decomposed. John D. Hoff, of Escondido, Superintendent.

*Owens Mine* (Quartz).—It is in the town of Julian. See our VIth, VIIIth, IXth, Xth, and XIth Reports, pp. 85, 87, 519, 144, 541, and 378.

*Oxide Mine* (Quartz).—See Bay View Mine.

*Pacific Mining District*.—It is in the Chuckawalla Mountains, partly in San Diego and partly in Riverside County. Several new discoveries are reported. A prospector who spends most of his time in that region stated in the summer of 1894 that no rain had fallen in the district since 1889. See our Xth Report, p. 900.

*Padre y Madre Mine* (Quartz).—It is in the Cargo Muchacho District, 4 miles E. of Ogilby. Leased by the Paymaster Company.

*Pasadena Mine* (Quartz).—It is in the Cargo Muchacho District, 4 miles E. of Ogilby, on the S. P. R. R. See our XIth Report, p. 386. Thos. Grunes & Co., of Pasadena, owners.

*Paymaster Mining Company*.—See Cargo Muchacho.

*Picacho Mine* (Placer).—See California Picacho.

*Pine Valley District*.—See Bay View Mine.

*Pot Holes Mines* (Placer).—They are on the Colorado River, about half way between Yuma and the California Picacho Mines. In the summer of 1894, Mexicans were hauling the gold-bearing dirt to the rivers, there being no water at the mine.

*Queen Mine* (Quartz).—See Golden Cross Mining Company.

*Ready Relief Mine* (Quartz).—This property is in the Julian District, at Banner. See Julian District; also our VIth, VIIIth, IXth, Xth, and XIth Reports, pp. 87, 513, 147, 543, and 387. Bailey Bros., of Banner, owners.

*Redman Mine* (Quartz).—It is in the Julian District, at Banner, and is the northern extension of the Ready Relief. See our VIth and IXth Reports, pp. 87 and 380. Bailey Bros., of Banner, owners.

*Ruby Mine* (Quartz).—It is in the Julian District, at Banner. See our XIth Report, p. 380.

*Shenandoah Mine* (Quartz).—See Black Eagle Mine.

*South Hubbard Mine* (Quartz).—It is in the Julian District, half a mile W. of Banner. See our VIth and XIth Reports, pp. 87 and 380. Bailey Bros., of Banner, owners.

*South Ruby Mine* (Quartz).—It is also in the Julian District, at Banner. See Julian District. H. Barry, of Riverside, owner.

*Spring Mine* (Quartz).—See Bay View.

*Stonewall Mine* (Quartz).—This property is on the Cuyamaca Grant, 10 miles S. of Julian. Since the publication of our last report operations have been suspended. See our VIth, VIIIth, IXth, Xth, and XIth Reports, pp. 89, 515, 143, 540, and 382. Sather Banking Company, of San Francisco, owners.

*Treasury Mine* (Quartz).—See Bay View Mine.

*Warlock Mine* (Quartz).—It is in the Julian District, 1 mile from Banner, on the Julian road. See our Xth Report, p. 544. W. H. Bradley, of Los Angeles, and W. W. Boswell, of Banner, owners.

*Washington Mine* (Quartz).—It is in the town of Julian. See our IXth Report, p. 145. Ex-Sheriff McDowell, of San Diego, owner.

*Wilcox Mine* (Quartz).—It is in the Julian District, at Banner. See our XIth Report, p. 145. L. E. Lee Electric Supply Company, of San Francisco, owners.

*Wild Cat Mine* (Quartz).—See Black Eagle Mine.

#### SAN LUIS OBISPO COUNTY.

*La Panza Mines* (Placer).—The gold from these mines has been taken chiefly from two creeks, Navajo and De la Guerra, which head on the eastern slope of the San Luis range, near La Panza. While both creeks flow over granite for several miles where the placer gold is found, yet their very sources, particularly that of De la Guerra, are in the Chico conglomerates and sandstones, which cap the southern portion of the range. Whether the gold came from the sedimentary beds or from hidden veins in the granite is not certain. No gold-bearing quartz veins have been found. The gold is generally coarse. All the gold easily gotten at has been taken out, but the heads of many gulches, in which the boulders are too large to move by hand, have never been touched. See our VIIIth and Xth Reports, pp. 530 and 578.

#### SAN MATEO COUNTY.

Auriferous beach sands occur along the shore of the Pacific Ocean for several miles in this county. They have been worked in a desultory sort of way by many persons, but as far as known without profit. The gold is very fine and is saved with difficulty.

#### SANTA CRUZ COUNTY.

Auriferous beach sands are found for miles along the coast of Santa Cruz County, and spasmodic attempts have been repeatedly made to work them. Under favorable conditions, the richer deposits have paid small wages to industrious workers.

*Stribling Mine* (Quartz).—This is 3 miles N.W. of Santa Cruz. Numerous shallow pits, cuts, and shafts have been made on the property, and one surface stope 30 ft. deep was made some years ago. A tunnel 100 ft.

long is run underneath this shoot of ore 25 ft. lower, but no good rock was found. A small stamp mill was erected several years ago, and this was replaced by a cannon-ball mill. The latter gave no satisfaction. Some new exploitation is contemplated at a lower level, the intention being to run a tunnel on the vein and cross-cut the several fissures. This mine is one of a number of points on the course of a mineral zone which trends in a N.W. direction through these granite hills. At one point a mile N.W. of the Stribling Mine, is what is known as the *Big Boulder Mine*. It appears that years ago a large boulder or mass of quartz was found lying on the surface of the ground, gold being seen on all sides of it. The boulder was broken up and ground in arrastras, producing gold to the amount of \$35,000 to \$50,000, according to the various stories. A great deal of work of a superficial character has since been done in the vicinity, but nothing of value discovered, though small veins are numerous. The rich boulder occurred in all probability nearly *in situ*, the soft, easily decomposable granite having been eroded from around it. The character of the deposits as far as observed is what is known as "pockety." The veins or masses of quartz form sometimes on the hanging- and sometimes on the foot-wall of the crevice, and again on both sides. Much of the so-called ore still shows the original granitic structure. Where the replacement has been more complete the quartz is massive and sometimes crystallized. All of the gulches and ravines heading in this gold-bearing region produce placer gold, and in the aggregate have yielded some thousands of dollars of the precious metals.

*Thurber Mine* (Placer).—It is 10 miles N.W. of Santa Cruz City, on Majors Creek; two men are working a placer mine for gold. The harvest of these laborers is evidently not great, as it is said they are working ground which has been sluiced twice before.

#### SHASTA COUNTY.

While having a diversity of economic mineral equal to that of any county in the State, Shasta does not take rank in point of output that it might, or that any person who has ever been over the ground would naturally expect. There are various causes for this, and it may be attributed, as far as her copper and silver ores are concerned, to the low prices of these metals, which preclude any profit being derived from the working of such mines, which are located on an extensive belt traversing the county.

That the gold output is not larger lies in the difficulty experienced in successfully working the ores on the spot. Comparatively few of the mines carry a true, free-milling ore, but depend upon the sorting and shipping of the high-grade sulphide ores, leaving the lower grades in the mine. None of the mines have attained a great depth, from an apparent fear of the owners that the pay ore does not extend down, although the success of such mines as the Uncle Sam and the Texas Consolidated would appear to indicate that these fears are groundless.

The county contains large areas of gravel, stretching from the neighborhood of Ono to the southwest, parts of which appear to be the remains of an ancient beach. Where they lie adjacent to the crystalline rocks they are gold-bearing, and may well repay, in places, the cost of drifting. An interesting fact in connection with the gravel deposits in this county is the development of pay gravel under 40 ft. of sandstone, as



found in the Sacramento Pliocene Mine, in Oregon Gulch. As this sandstone can be traced for quite a distance northward, it is possible that in other portions pay gravel may be encountered beneath.

It is much to be regretted that the works hitherto established in this county to handle its refractory gold ores, have not proved a marked success, allowing a lower grade of ores to be mined and worked. Parties, we believe, are again preparing to undertake this work with improved methods, and their success will mean an increased output of bullion, as well as the retention in the county of a large amount of money.

*Alice Mine* (Quartz).—It is 1,500 by 600 ft., and 6 miles N.W. from Ono. The vein courses N.E. and dips  $24^{\circ}$  W.; the walls are porphyry, with from 8 to 30 in. of quartz between them, which carries a large percentage of iron sulphurets. Developments consist of a cross-cut tunnel to the vein, 150 ft. long; one on the vein 200 ft. long, and giving 60 ft. of backs. None of the ore has been milled. J. J. Murray, of Ono, owner.

*Alice Mine* (Quartz).—This claim, 1,500 by 600 ft., is  $2\frac{1}{2}$  miles N. of Shasta. The vein, 4 ft. wide, courses N.E. and dips  $55^{\circ}$  S.W., between porphyry walls. The apex has been excavated for several hundred feet, and an incline shaft sunk to a depth of 40 ft. The ore carries 0.75 per cent of sulphurets. D. B. Hunt et al., of Stella, owners.

*American Mine* (Quartz).—It is in Kline's Gulch,  $3\frac{1}{2}$  miles from French Gulch, and comprises three 40-acre lots. The vein courses N.  $63^{\circ}$  E. and dips  $75^{\circ}$  S.E., between a porphyry hanging- and slate foot-wall, varying in width from 4 to  $7\frac{1}{2}$  ft. There are four tunnels; three run east on the vein, 90, 80, and 60 ft., while the lowest is a cross-cut, running due north in slate 650 ft. From 4 to 5 in. of water issues from the workings. A 5-stamp mill, run by water about seven months in the year, belongs to the property. J. Conant, of Redding, owner.

*Anavina Claim* (Quartz).—This claim, 1,500 by 600 ft., is 8 miles W. of Redding. The vein courses N. and S., dipping a little E., between a black shale foot- and a quartzite hanging-wall. Developments consist of a shaft sunk 54 ft., with a 30 ft. drift at the bottom, all in ore. The quartz is heavily mineralized, carrying iron, copper, and galena. M. C. Christensen and C. Jones, of Igo, owners.

*Balaklava Mine* (Quartz).—It is 7 miles W. from Kennett, and comprises several claims. The vein courses N.W.; the width not yet established. It is on the same ore body as found in the Iron Mountain Mine, though not so extensive, and carries iron, copper, gold, and silver. New York Company, owners; — Weil, of Redding, Superintendent.

*Bell Mine* (Quartz).—It is on Sunny Hill, 7 miles W. from Ono, at an elevation of 2,900 ft. The vein, 4 to 6 ft. wide, courses N. and S. in porphyry. The ore is sorted and shipped. Developments consist of a cross-cut tunnel about 180 ft. long, thence turned north on the vein over 300 ft. and south 260 ft. From tunnel level to surface the ground is largely stoped out. J. Bell, of Shasta, owner.

*Black Diamond Mine* (Quartz).—See South Fork Mining and Milling Company.

*Blackfoot Mine* (Quartz).—It is 4 miles S. of Shasta, and comprises 1,500 by 600 ft. The vein courses N. and S., lying vertical between a porphyry hanging- and slate foot-wall, very variable in width—from 6 in. to 5 ft. The quartz carries 0.5 per cent of sulphurets, which are hand-sorted and shipped. Developments consist of a 45 ft. shaft sunk on the

vein, and drift at bottom 40 ft. to the south and 31 ft. to the north; the south drift has been stoped to within 10 ft. of the surface. W. A. Boswell, of Shasta, owner.

*Black Prince Mine* (Quartz).—See South Fork Mining and Milling Company.

*Black Spider Mine* (Quartz).—It is near Shasta, and contains 1,500 by 380 ft. The 8 ft. vein courses N.  $63^{\circ}$  E., dipping  $72^{\circ}$  N.W., between greenstone and porphyry walls. The quartz carries 5 per cent of sulphurets, mostly iron and copper. Developments consist of a shaft 40 ft. on the foot-wall side of the vein, and some surface cuts. It cost \$10 a foot to sink the shaft. A blower is required for ventilation. J. Bell and J. Scranton, of Shasta, owners.

*Blue Bird Mine* (Drift).—This claim of 20 acres is half a mile S. of Igo. The average depth of the gravel is 35 ft., with 40 ft. of lava capping on the west side. The main tunnel, 120 ft. long, is partly in granite bedrock. The course of the channel is N. and S., with 10 ft. of pay gravel, carrying coarse gold worth \$17 per ounce. Next to the bedrock the boulders are very large. The Dry Creek Water Company furnish the water. Only a few boxes are used for washing, which are cleaned up monthly. T. White, of Igo, owner.

*Centennial Mine* (Quartz).—See Niagara.

*Central Mine* (Quartz).—See our VIIIth Report, p. 565. This is 8 miles N. of Redding, and comprises three claims. The vein courses N. and S. and dips  $80^{\circ}$  E., between porphyritic walls from 1 to 4 ft. apart. The quartz carries 5 per cent of sulphurets. Developments at present are confined to a lower main tunnel, cross-cutting 956 ft., thence turned 431 ft. on the vein, giving 350 ft. of backs. Half a mile from the mine, near the river, are two Huntington mills and eight Frue vanners run by a 40 horse-power engine. Timbers are delivered at the mine for 6 cents per running foot, and cordwood (pine and oak) for \$4 per cord. Whitehouse, Bliss et al., of Shasta, owners.

*Cleveland Mine* (Quartz).—See Eureka Tellurium.

*Clipper Gold Mine* (Quartz).—This is 8 miles W. of Kennett, and comprises nine claims. The vein courses N.  $80^{\circ}$  W. and dips about  $50^{\circ}$  N., with a width varying from 1 to 12 ft., in porphyritic rock, the quartz carrying  $1\frac{1}{2}$  per cent of sulphurets. Developments consist of a shaft with drifts every 50 ft. down to the 150 ft. level, and two tunnels, one of which cuts the shaft. Ore at present comes from the second level. The 10-stamp steam mill has two Woodbury concentrators. A Hallidie tramway conveys the ore 1,500 ft. to the mill. W. V. Huntington et al., of Kennett, owners.

*Colorado Mine* (Quartz).—This claim is 2 miles S.W. from Shasta, and comprises 1,500 by 600 ft. The 3 ft. vein courses E. and W. and dips  $55^{\circ}$  S., between porphyry and granite walls. The ore carries large masses of ferruginous quartz, also a considerable percentage of sulphides. E. P. Connor, of Shasta, owner.

*Colorado Mine* (Quartz).—See Remonia.

*D & B Mine* (Quartz).—See Remonia.

*Deakin & Taylor Mine* (Quartz).—It is  $1\frac{1}{2}$  miles S.E. of Shasta, and comprises 105 acres of land, containing the *Spanish*, *Taylor*, *Enright*, and *South* veins. The Spanish vein,  $3\frac{1}{2}$  ft. wide, courses E., and is nearly vertical, with granite hanging-wall and slate foot-wall. There

is a 210 ft. tunnel run on the ledge, also a shaft 45 ft. deep. The quartz carries  $1\frac{1}{2}$  per cent of sulphurets.

The Taylor lode,  $2\frac{1}{2}$  ft. wide, has an E. and W. course, dipping  $70^{\circ}$  N. between granite and porphyry walls. The quartz is sorted and shipped, and carries  $2\frac{1}{2}$  per cent of sulphides. The vein has been opened by 200 ft. of tunnel and a shaft sunk 65 ft.

The South vein, 4 ft. wide, runs E. and W. and dips  $50^{\circ}$  N., between granite and porphyry walls. The vein carries a good deal of "gossan"; the ore is high grade. There is only a 12 ft. shaft on this vein.

The Enright vein, 2 ft. wide, courses E. and W. and dips  $50^{\circ}$  N., between granite and porphyry walls. F. H. Deakin and T. G. Taylor, of San Francisco, owners.

*Denver Mine (Quartz).*—See Remonia.

*Doeblein's Claim (Hydraulic).*—This is 2 miles E. of Igo, comprising 200 acres. The bank consists of 14 to 25 ft. of gravel, with a lava capping of 100 ft. The slate rim rocks are 1,500 ft. apart; the channel has a N.E. and S.W. course. The gold is coarse and scaly; richest near the bedrock. Water is caught in reservoirs and brought to the claim through 6 miles of ditch, using 2,000 ft. of 8 in. pipe and a giant with 1 in. nozzle, under 100 ft. pressure. For washing, 200 in. of water are used, and 20 boxes paved with block riffles. G. Doeblein, of Igo, owner.

*Dolcsath Mine (Quartz).*—This claim, 1,500 by 600 ft., is 2 miles E. of Shasta. The course of the  $2\frac{1}{2}$  ft. vein is E. and W., dipping  $75^{\circ}$  S., between porphyry walls. The ore carries about 1 per cent of iron and copper sulphides. Developments consist of a 24 ft. perpendicular shaft, with an east drift. H. A. Wiser and J. Hill, of Shasta, owners.

*Dreadnaught Mine (Quartz).*—This claim, 1,500 by 600 ft., is 3 miles N.W. of Shasta. The  $2\frac{1}{2}$  ft. vein courses E. and W. with a dip of  $80^{\circ}$  N., between porphyry walls. The quartz carries 0.5 per cent of sulphurets, chiefly iron and copper. The quartz is worked in a 10 ft. arrastra, run by water from South Fork of Spring Creek; 1 ton is crushed per day, the water lasting four months. The developments are a 40 ft. tunnel and 20 ft. shaft, both on the vein. A. T. Molin, of Shasta, owner.

*Eastern Star Mine (Quartz).*—It is 14 miles S.W. of Redding, and consists of three claims. Connected with it are two other claims, known as the *Molly Maguire* and *Jim Blaine*. The veins course N.E. and S.W., dipping nearly vertical, between slate and porphyry walls. The Eastern Star vein is 4 ft. wide; the other two from a few inches to 1 ft., the quartz carrying a heavy percentage of sulphurets. Developments consist of a shaft 96 ft. deep on the Eastern Star, and on the others a tunnel 250 ft. long and a shaft 30 ft. deep. These veins make considerable water. J. W. George, of Igo, owner.

*Edna B Mine (Quartz).*—It is 4 miles N.W. of Redding. The course of the 3 ft. vein is a little E. of N. and dips  $45^{\circ}$  E., between porphyry walls. The ore carries a good percentage of sulphurets. Developments include a shaft 100 ft. deep, tapped by a tunnel 125 ft. long. The ore shoot found near the surface has not been cut by the tunnel. James Beecher, of Anderson, owner.

*El Dorado and Eureka Mine (Quartz).*—It is 12 miles N.E. of Shasta, and comprises 3,000 by 600 ft. The vein courses N.W. and S.E., dipping  $45^{\circ}$  S., with a width of from 3 to 20 ft., between slate and porphyry walls. The slate belt here is 3 miles wide. This is a new prospect. E. P. Connor, of Redding, owner.



*Emigrant Mine* (Quartz).—This claim, 1,500 by 600 ft., is 7 miles from Stella. The vein courses N.E. and S.W., and lies along the contact of the slate and porphyry, averaging 2 ft. in width. The quartz carries about 1 per cent of sulphurets of a good grade. Three tunnels are run on the vein, 160, 300, and 70 ft. long. C. A. Crowell, of Stella, owner.

*Enright Mine* (Quartz).—See Deakin & Taylor Mine.

*Ethel Mine* (Quartz).—This claim, 1,500 by 600 ft., is 14 miles S.W. from Redding. The 4 ft. vein courses N. and S., with vertical dip, between porphyry and quartzite walls. The quartz carries a heavy percentage of sulphurets. Developments consist of a 100 ft. cross-cut to the vein, a 20 ft. drift on the vein, and a 16 ft. winze. E. C. Norris and John Sparks, of Igo, owners.

*Eureka Tellurium Mine* (Quartz).—This is  $2\frac{1}{2}$  miles W. of Redding, on the N.W. corner of the Redding grant, along the Sacramento River and Salt Creek, comprising 290 acres. Four claims have been opened, known as the *Eureka Tellurium*, *Cleveland*, *Shaefer*, and *Herbert*. On the first a tunnel has been driven 600 ft. in a S.E. direction, cutting a 3 ft. vein, coursing N.  $25^{\circ}$  E., and pitching  $60^{\circ}$  S.E. This vein carries considerable calcspar and telluride ores, and is inclosed in metamorphic slate. An upraise 175 ft. on the incline connects with the surface; 90 ft. beyond, a second parallel vein is cut by the main tunnel; 400 ft. above, on the slope of the hill, an incline is sunk 99 ft. on the pitch of a 7 ft. vein, connecting at 58 ft. with a perpendicular shaft 74 ft. deep; from this a cross-cut has been run to the vein. The ore carries tellurides and about  $1\frac{1}{2}$  per cent of iron pyrites. A 10-stamp mill, with 850 lb. stamps, 8 ft. of apron plates, and two Woodbury concentrators, stands at the mouth of the main tunnel. These, and a compressor for two Phoenix machine drills, are run by a 40 horse-power engine. Peter J. Sherer, of Redding, Superintendent.

*Falls Gold Mine* (Quartz).—This is 4 miles W. from Igo, and comprises five claims, embracing a series of high-grade veins in the granite, varying from 3 in. to 2 ft. wide, and having a general N.E. and S.W. course. Developments consist of a number of small tunnels on the vein, from which the ore is sledged to a Tustin pulverizer, working 4 tons per day; thence it passes over a McGrew concentrator. The concentrates are worked by the barrel chlorination process, and both gold and silver are saved. The works are run by water power. E. L. Ballou, of Igo, owner.

*Florida Mine* (Quartz).—This claim, 1,500 by 600 ft., is 3 miles S. of Shasta. The 4 ft. vein courses E. and W. and dips  $60^{\circ}$  N., between porphyry and slate walls. The quartz shows a heavy percentage of iron sulphides, which are hand-sorted and shipped. Developments consist of two shafts, 600 ft. apart, 175 and 30 ft. deep; the former tapped by a tunnel 175 ft. long. Paying ore extends between both shafts. The mine makes 10,000 gallons of water per day. G. W. Boswell, of Shasta, owner.

*Gladstone Mine* (Quartz).—See our VIIIth, Xth, and XIth Reports, pp. 568, 637, and 45. This is in Kline's Gulch, 5 miles N.E. of French Gulch, and comprises six full claims. The vein courses N.  $63^{\circ}$  E., between a slate foot-wall and a porphyry hanging-wall. The quartz varies from 18 in. to 30 ft. in width, and what is unusual, the value per ton in gold increases with the width. The property is extremely well

situated for development through tunnels, of which there are five main ones, from 80 to 200 ft. apart; all are connected, enabling the tapping of the vein on the Carson claim, for instance, 900 feet below the apex. The principal working tunnel, the Ohio, cross-cuts the country 1,400 ft., and turns 300 ft. on the vein, exposing in the drift from 6 to 14 ft. of quartz, carrying about 1 per cent of sulphurets (iron and copper), also a little galena. About 25 in. of water issues from the tunnels. The reduction works consist of a 20-stamp mill run by water power four months in the year, and by a 140 horse-power engine the remainder of the time. There are four double Frue concentrators, besides two rockbreakers, self-feeders, etc. The stamps weigh 850 lbs. each, and have a duty of  $2\frac{1}{2}$  tons per stamp, when using No. 40 punched screens, and from  $4\frac{1}{2}$  to 6 in. drop, making 95 drops per minute. The apron is  $4\frac{1}{2}$  by 10 ft., set to a grade of 1 in. to the foot. The entire works are lighted by electricity. Electric bells are used in the lower workings. The water power is derived from Kline's Gulch through a ditch 1 mile in length. Owned in Cleveland, Ohio.

*Green Mine (Quartz).*—This is  $3\frac{1}{2}$  miles W. of the town of French Gulch, and comprises 4,500 by 600 ft. The vein courses N. and S., and dips  $45^\circ$  E., with an average width of 2 ft., between a slate hanging-wall and porphyry foot-wall. The quartz carries 1 per cent of sulphurets. Developments consist of three tunnels: 600, 400, and 360 ft. on the ledge. Nos. 1 and 2 are connected, and from No. 2 to the surface the greater amount is stoped. The tunnels are, respectively, 160, 1,000, and 200 feet apart, giving nearly 500 ft. depth from the surface to the lower level. The ore is hauled half a mile to the mill, at an expense of 40 cents a ton. A 5-stamp steam mill reduces the ore, which passes through a rockbreaker and roller ore-feeder. The stamps are run at 85 drops, on a 5 in. drop and 8 in. discharge, crushing  $1\frac{1}{2}$  tons to the stamp through a No. 10 slot screen. The apron plate is 10 ft. long, set to a grade of  $1\frac{3}{8}$  in. to the foot, with an equal length of sluice plates 24 in. wide. A Frue concentrator gathers the sulphurets. The plates are scraped once a day, and the battery, which is supplied on the inside with front and back plates, is cleaned up once a month. Two thirds of the amalgam by weight, but 75 per cent by value, is taken from the battery, as against one third and 25 per cent from the outside plates. The power is derived from a 25 horse-power engine, consuming  $1\frac{1}{2}$  cords of wood per day; cordwood costs \$2 25. There is a possibility of running by water during five months in the year. The ground in the mine requires substantial timbering. Kelly, Frank & Co., of French Gulch, owners.

*Gypsy Gold and Silver Mine (Quartz).*—This claim, 1,500 by 600 ft., is 2 miles S.W. from Shasta. The 4 ft. vein courses E. of N., with vertical dip, between granite and diorite walls. Developments consist of a 50 ft. shaft on the vein and a drift started at 25 ft.; also two open cuts. J. B. Timmonds, of Redding, owner.

*Hardscrabble Mine (Hydraulic).*—It is at Igo, and comprises 1,720 acres, only a portion of which is gravel. The bank is from 20 to 80 ft. high, and the gravel contains about 25 per cent of bowlders and cobbles. It carries fine gold, worth \$17 per ounce. Twenty-five acres have been worked. Hober and Eagle creeks and South Fork of Clear Creek furnishes the water through 25 miles of main ditch, which carries 1,300 in. of water. The property is idle at present, not having placed any

restraining dams for the debris. Merchants Exchange Bank, of San Francisco, owner.

*Hartman Mine* (Quartz).—This claim, 1,500 ft. by 600 ft., is  $3\frac{1}{2}$  miles N. of Whiskytown. The vein courses N.E. and S.W. with a N.W. dip, between porphyry walls about 2 ft. apart. Developments consist of two tunnels about 50 ft. long, driven on the vein, and a 45 ft. shaft. W. Hartman, of Stella, owner.

*Herbert Mine* (Quartz).—See Eureka Tellurium Mine.

*Hidden Treasure Mine* (Quartz).—This property, 6,000 by 600 ft., is 8 miles N.E. of Shasta, on the road to Iron Mountain. The vein courses N.  $85^{\circ}$  E., dips  $70^{\circ}$  N., and varies from 10 in. to 7 ft. in width, between quartzite and porphyry. The ore carries less than 1 per cent of sulphurets, mostly copper, and is said to contain some telluride. Developments consist of two cross-cut tunnels, 80 and 318 ft. long and 110 ft. apart perpendicularly, starting from Slick Road Gulch. The first is turned at 100 ft. on the vein and has an upraise of 60 ft. The second is turned at 100 ft. and runs 90 ft. E. on the vein. Both are connected, and an intermediate drift has been started. Some stoping has been done above the upper tunnel. The ground costs \$10 per foot to drive through. The property includes a 10-stamp mill, with aprons 10 ft. in length, and a Johnston concentrator, run by a 4 ft. wheel with Pelton buckets, under 200 ft. pressure. The water is obtained from Slick Road Creek, being only sufficient for 5 stamps in summer. D. Jennings, of Craig, Ill., owner.

*Honeycomb Mine* (Quartz).—See Niagara.

*Hull & Murray Mine* (Quartz).—This claim, 4,000 by 600 ft., is 4 miles N. of Shasta. The vein courses N.E. and S.W., dipping  $45^{\circ}$  N., in porphyry. The ore carries 1 per cent of iron and copper pyrites. There is a 100 ft. tunnel on the vein and a perpendicular shaft 76 ft. deep. Hull, Murray et al., of Redding, owners.

*Iron Mask Mine* (Quartz).—It is  $6\frac{1}{2}$  miles from Whiskytown (Stella P. O.), and comprises six claims. Only two of these, the *Iron Mask* and *Pluto*, have developments. The vein is on a contact having a N.E. and S.W. course. Several tunnels are run, some on the vein and others cross-cutting. On the Iron Mask proper is a 200 ft. tunnel on the contact, as well as two other tunnels, respectively 200 ft. and 130 ft. in length. On the Pluto claim are two cross-cut tunnels, 60 and 100 ft. in length, which have not yet reached the vein. The property has a 5-stamp mill  $3\frac{1}{2}$  miles from the mine, on Clear Creek, at foot of Grizzly Gulch, which is run by water from Clear Creek. The quartz carries some sulphurets of a good grade. S. W. Levy, of San Francisco, owner.

*Jay Eye See Mine* (Quartz).—This is  $4\frac{1}{2}$  miles N.E. from French Gulch, and comprises four full locations. The fissure vein courses N.  $63^{\circ}$  E. and dips  $60^{\circ}$  to  $75^{\circ}$  N., within slate walls, the vein running against the course of the slate. The width of the quartz is from 8 in. to 4 ft. Developments comprise a shaft 4 by 6 ft., and 38 ft. deep; a cross-cut tunnel 146 ft. long, cutting an 18 in. vein, which is drifted on 160 ft. E. and 125 ft. W., showing in the breast a vein from 18 in. to 2 ft. in width, with 160 ft. of backs to the surface. Also a 90 ft. winze with short drifts both ways. A second cross-cut tunnel, 375 ft. to the vein, through slate rock, is turned  $75^{\circ}$  E. on the vein and 60 ft. W., showing a 4 ft. vein on the face, and giving 236 ft. of backs. About 6 in. of water runs from this tunnel. An upraise 130 ft. long connects



tunnels Nos. 1 and 2 with an intermediate tunnel 30 ft. above No. 2, which is turned both E. and W., showing the vein to be 1 to 4 ft. wide. There is no mill on the property, but water power under 150 ft. pressure is obtainable during six months in the year for 10 stamps. G. W. Van-meter et al., of French Gulch, owners.

*Jim Blaine Mine* (Quartz).—See Eastern Star.

*Jim Fisk Mine* (Quartz).—This claim, 1,500 by 600 ft., is in Muletown, 3 miles N. of Igo. The vein courses N. and S. with a slight dip to the W., between granite walls, with an average width of 1 ft. Developments consist of a shallow shaft and a small tunnel run to intersect it; these show quartz carrying considerable ochre, rich in free gold, which is sorted for shipment. The mill is an invention of one of the owners, and consists of a self-feeder with jarring motion, supplemented by a small stream of water conveying quartz into an upright iron cylinder 16 in. in diameter and 2 ft. high, with concave bottom, having a small cone in the center. At the circumference is a grooved iron ring, into which fits an iron curved shoe fastened at one end by an iron arm to an upright shaft, revolving by the means of a spur-gear wheel making 150 revolutions per minute. This shoe, which is 12 in. long and weighs 18 lbs., is forced into the groove of the iron ring by centrifugal force, grinding the ore. Eight inches above the bottom of the cylinder is an annular No. 60 brass wire screen 4 in. high. A  $\frac{3}{4}$  in. iron pipe surrounds the cylinder on the inside below the screen, through which the exhaust steam from the engine is led. The pulp on leaving the screen is conducted into a copper cylinder 18 in. high and 1 ft. in diameter, amalgamated with quicksilver on the inside, where it is kept in rotary motion by a stirrer. After passing through two of these cylinders the pulp is allowed to escape. Both cylinders as well as the crusher are charged with quicksilver, and from a vessel placed above the feeder drops of cyanide of potassium solution are introduced into the mill; sodium is also added to the quicksilver. The mill crushes  $2\frac{1}{2}$  tons of rock in twenty-four hours. The power is furnished by a small 6 horse-power steam engine with upright boiler, consuming one fourth of a cord of wood. The machine is an experimental one, and is to be altered in some of its features, but appears to do fair work. E. Jones and H. C. Christensen, of Igo, owners.

*Jumbo Mine* (Quartz).—See Niagara Mine.

*Last Chance Mine* (Quartz).—This claim, 1,500 by 600 ft., is  $2\frac{1}{2}$  miles N.E. from Igo. The  $2\frac{1}{2}$  ft. vein courses N.E. and S.W., dipping  $70^\circ$  W., with slate and porphyry walls. E. C. Norris and John Sparks, of Igo, owners.

*Lava Bed Mine* (Drift).—This is 5 miles S.W. from Redding, and comprises a tract of 40 acres in Oregon Gulch, in Sec. 15, T. 31 N., R. 5 W. About 12 ft. of lava capping overlies 2 to 4 ft. of gravel, with an average width of 100 ft. The gravel is dark and tight, carrying fine gold, worth \$16 75 per ounce. A tunnel has been run, partly in the bedrock, 250 ft., and the gravel breasted out 100 ft. wide and from 3 to 4 ft. high; timbered with posts and caps; 300 ft. of the channel has been worked. The mine makes about 600 gallons of water per day; 30 inches of wash water are obtained from Irish Gulch, being conveyed through 3 miles of ditch. Seven boxes are used, paved with slat riffles set on an 8 in. grade to the box. The water season lasts from December to March. A. L. Parsons, of Redding, owner.

*Lodi Mine (Quartz).*—It is 4 miles W. from Igo, and comprises two claims. The 6 in. vein courses N. and S. and dips about  $35^{\circ}$  E., between granite walls; it carries a large percentage of lead and iron sulphurets. Developments consist of a 60 ft. shaft and two tunnels about 35 ft. in length; no mill. W. D. Bull, of Igo, owner.

*Lost Buck Mine (Quartz).*—This claim, 3,000 by 600 ft., is 6 miles N.W. from Ono. The vein courses N.W. and S.E. and dips  $15^{\circ}$  E.; has a width of 8 in. to 2 ft.; the walls are micaceous schist; the quartz carries some sulphurets. Developments consist of a tunnel on the vein 200 ft. in length, giving 85 ft. of backs; stoped nearly to the surface. H. Arkarro, of Ono, owner.

*Mad Mule (Banghart's) Mine (Quartz).*—It is 5 miles N.W. of Whiskytown, and comprises 4,500 by 600 ft. Peculiar features are connected with this pocket mine, located on a porphyry dike from 50 to 300 ft. wide; the pay being in connection with black slate that lies folded and crumpled in the porphyry, and is traversed with seams of quartz. The apex of the upper curve of the folding seams carry the most gold when the quartz butts up to the porphyry. As high as \$10,000 has been taken out of one of the contact points; the gold is coarse, adhering to quartz pieces, and is sold at \$17 25 per ounce. The mine is worked by tunnels starting from Mad Mule Gulch on different levels along the contact of the dike, following the general N.E. course of the porphyry. The ore is washed, and worked up with a large hand mortar and spring-pole pestle. The tunnels furnish the necessary water for washing the ore. Elleigh & Rea, of Stella, owners.

*Mad Ox Mine (Quartz).*—This is 5 miles N. from Stella (Whiskytown), and embraces 4,500 by 600 ft. The 4 ft. vein courses N. and S., with nearly a vertical dip, between slate and quartzite, and carries high-grade ore. Developments consist of a main cross-cut tunnel 1,600 ft. in length to the vein. The tunnel cost \$19,000, and reaches a depth of 700 ft. on the vein. L. Reil and J. W. Woodward, of Stella, owners.

*Mammoth Mine (Quartz).*—See our VIIIth Report, p. 568. This is  $8\frac{1}{2}$  miles N. of Redding, and comprises two claims. The vein runs N.W. and S.E., and a tunnel for prospecting purposes is being driven. S. Cheney, of Philadelphia, owner.

*Manlove Mine (Quartz).*—This claim, 1,500 by 600 ft., is  $3\frac{1}{2}$  miles N. of Whiskytown. The vein courses N.E. and S.W. with a N.W. dip, between porphyry walls about 2 ft. apart. Developments consist of a 45 ft. shaft and two tunnels about 50 ft. long, driven on the vein. J. E. Manlove, of Perkins, Sacramento County, owner.

*Mascot Mine (Quartz).*—This claim, 1,500 by 600 ft., is 2 miles W. from Shasta. The 4 ft. vein courses N. and S. and dips  $60^{\circ}$  W., between porphyry and granite walls. A tunnel is driven 100 ft. on the vein, the first 40 ft. being timbered. W. Herron, of Redding, owner.

*Mechado Claim (Quartz).*—This claim, 1,500 by 600 ft., is 3 miles N.E. from Igo. The vein courses N. and S. in granite, dipping vertical. The quartz carries 10 per cent of sulphurets. Developments consist of two shafts sunk on the vein about 14 ft. deep. — Mechado, of Igo, owner.

*Miner's Dream Mine (Quartz).*—This is  $3\frac{1}{2}$  miles S. from Shasta, and comprises 1,500 by 600 ft. The 4 ft. vein courses E. and W. and dips  $50^{\circ}$  N., between a slate hanging-wall and porphyry foot-wall. The developments are meager, consisting of a 40 ft. shaft sunk on the vein and 40 ft. of drift at the bottom, with about 30 ft. in length partly

stoped. The quartz carries some iron and copper sulphides. W. A. Boswell, of Shasta, owner.

*Minnesota Mine* (Quartz).—See Rattler.

*Mocking-Bird Mine* (Quartz).—This claim, 1,500 by 600 ft., is 14 miles S.W. of Redding. The vein courses N.E., dipping slightly E., and is from 4 to 22 in. wide, in syenite. The developments consist of a perpendicular shaft 80 ft. deep, and at the 40 ft. level two short drifts 20 ft. in length. W. Dunham, of Igo, owner.

*Molly Maguire Mine* (Quartz).—See Eastern Star.

*Murray Mine* (Quartz).—This claim, 1,500 by 600 ft., is 2½ miles S.W. from Copely. The 18 ft. vein courses E. and W., dips 50° S., with syenite hanging-wall and porphyry foot-wall. Developments consist of a tunnel 400 ft. long from the south; at 150 ft. it strikes the vein and turns on the same; two winzes of 25 ft. are started on the tunnel level. The ground above is stoped. Ventilation is secured by fire blast. A fine water power of 200 ft. pressure can be had. Barney Conroy, of Redding, owner.

*Nelson Gold Mine* (Quartz).—This claim, 1,500 by 600 ft., is 7 miles N. of Stella, on Grizzly Gulch. The vein courses N.E. and S.W. on the contact of the porphyry and slate, and carries from 1 to 2 ft. of quartz. Developed by two tunnels 600 ft. apart, driven on the vein. C. A. Nelson, of Stella, owner.

*Niagara Mine* (Quartz).—See our Xth Report, p. 636. It is 5 miles W. of French Gulch, on the south fork of the gulch, and comprises twenty-two patented claims, including 320 acres of timber land. Seven of the claims, known as the *Niagara*, *Scorpion*, *Summit*, *Centennial*, *Honeycomb*, *Jumbo*, and *Shea*, have been more or less worked. At present the works are principally on the *Niagara*, *Scorpion*, and *Summit*. The veins course E. and W. and dip 70° N., along the contact of slate and porphyry, having an average width of 2 ft. The ore carries 2 per cent of sulphurets. A ferruginous ore exists in the *Niagara*, showing few sulphurets and very little free gold with the horn, but which assays from \$500 to \$1,100 per ton in gold. This grade of ore is all shipped. The recognizable sulphides are iron and galena. The gold sells for \$16 50 per ounce, but it has been noted that in going west the quality of the gold improves.

On the *Niagara* are four main tunnels cross-cutting to the vein. No. 1 is 662 ft. to the vein; No. 2 (the O'Neil) is 1,098 ft.; No. 3, 185 ft., and No. 4, 441 ft. The ore shoot here has a length of 180 ft., and has been proved 400 ft. deep. The *Scorpion* and *Summit* veins are each opened by three tunnels.

On the *Niagara* claim is an 18-stamp and on the South *Scorpion* a 10-stamp mill, both supplied with Frue concentrators and run by steam; at present only 10 stamps are dropping. These are speeded to 85 drops per minute, with a 6 in. drop and 7 in. discharge through a No. 40 mesh screen. The aprons are 10 ft. long and have 1¼ in. grade to the foot; the sluice-plates, 15 by 2 ft., are somewhat flatter. W. T. St. Aubyn, of French Gulch, Superintendent.

*North Star Mine* (Quartz).—This claim is 1,500 by 600 ft., and is 2½ miles N.E. of Igo. The 3 ft. vein courses N. 20° E. and dips W., in slate walls. The developments are a 90 ft. shaft on the vein and a cross-cut. The quartz carries a large percentage of sulphurets.



*Original Gravel Mine (Drift).*—This is half a mile W. of Centerville, and comprises 100 acres. The owners are sinking through sandstone to strike gravel beneath on bedrock. A circular shaft, now 45 ft. deep, is being carried down through the sandstone, which is assuming a conglomerate nature. J. P. & E. Rathbun, of Colusa County, owners.

*Original Quartz Hill Gold Mine (Quartz).*—This is  $4\frac{1}{2}$  miles N.E. of Redding, near the Sacramento River, comprising three claims, designated the *Quartz Hill*, *Storm*, and *Snow*. The Original Quartz Hill Mine consists of two parallel lodes, whose croppings are 98 ft. wide, of solid quartz, and 1,200 ft. long, forming a hill 125 ft. higher than the surrounding country, with a pay shoot 622 ft. long. The "main lode," with the parallel "red ledge," which is blind, courses in conformity with the metamorphic slate country rock N.  $40^{\circ}$  W., but varying in the dip, dipping east for the upper 113 ft., then west. A tunnel 168 ft. long cuts the main ledge 75 ft. below the surface, passing for 74 ft. through metamorphic slate, then crossing the red ledge 25 ft., and through 28 ft. more of slate into a gouge from 5 to 8 ft. thick, and 36 ft. of quartz of the main ledge. From this level an incline was sunk 47 ft. in the hanging-wall gouge, disclosing a 5 ft. quartz vein coming in from the east at a depth of 24 ft., where the dip changed. From the bottom of the incline a cross-cut run west cuts the main lode at a total depth of 112 ft. The main lode carries along the center from 5 to 6 ft. of high-grade quartz, separated from the rest by a casing of talcose schist, in which wire gold is found. The dimensions of the pay shoot as far as explored are, on the "red ledge," 333 ft. long, 25 ft. wide, and 112 ft. deep; on the "main lode," 622 ft. long, 30 ft. wide, and 112 ft. deep. A steam Burleigh drill is being put in place to work the outcrop on the southwest end in benches (quarrying), the quartz being conveyed over a tramway  $3\frac{1}{2}$  miles in length to the 34-stamp mill on the Sacramento River, which consists of two 12-stamp, iron, circular batteries, and two 5-stamp batteries, with aprons 5 by 10 ft., set on a  $1\frac{1}{4}$  in. grade to the foot, four Frue vanners, and two canvas tables 20 ft. long and wide, divided into ten sections each. The bullion is .603 fine in gold and .378 in silver. The motive power is water, brought through 7 miles of ditch and flume and a 2,000 ft. pipe-line, reducing from 18 in. to 15 in., and bridged across the Sacramento River, working under a 220 ft. pressure on an 8 ft. Knight wheel. M. Maryanski, of Middle Creek, Superintendent.

*Pluto Mine (Quartz).*—See Iron Mask.

*Potosi Claim (Quartz).*—This is 12 miles S.W. from Redding, and comprises 3,000 by 600 ft. The 15 in. vein courses N. and S., with a westerly dip; the walls are a syenitic granite; the quartz high grade. Hon. John P. Jones, of Gold Hill, Nevada, owner.

*Pugh & Lindsay Mine (Quartz).*—This claim, 6,000 by 600 ft., is 3 miles W. from Shasta City, on Clear Creek, and has three parallel veins, coursing E. and W., with a dip of  $55^{\circ}$  N., and a fourth vein with a N.E. and S.W. course, all in quartz porphyry, and averaging 18 in. to 3 ft. in width. Developments consist of a shaft 60 ft. deep on one of the veins, a tunnel 60 ft. in length on another, and a tunnel 40 ft. long on a third vein. The quartz carries 0.5 to 1 per cent of sulphurets. The reduction works comprise a Kendall rocker mill, with a duty of 6 tons per twenty-four hours when using No. 9 or 10 screens, and rocking twenty-eight times per minute. Pugh, Lindsay et al., of Shasta, owners.

*Rattler (Minnesota) Mine* (Quartz).—See our Xth Report, p. 635. It is  $3\frac{1}{2}$  miles W. of Copely, and comprises two full claims, besides 160 acres of timber land. The course of the 5 ft. vein is E. and N., dipping  $80^{\circ}$  N., between trap and slate walls. There are four tunnels; the upper, or No. 1, runs 280 ft. on the vein, which has been stoped both above and below it; No. 2, 105 ft. below, runs 35 ft., showing a 5 ft. vein in the breast; No. 3, 174 ft. below No. 1, has been driven 125 ft., connecting at the breast through an incline with No. 4, or main tunnel, which is 1,200 ft. long and shows at 1,100 ft. a ferruginous cross-ledge carrying gold, and is 240 ft. below tunnel No. 1. The main tunnel is being driven ahead to cut the ore shoot that was stoped below No. 1 tunnel. The ore carries about 0.5 per cent of sulphides of iron and copper. The company controls three mountain streams that unite at the mine, giving a large water power. The plant consists of a small sawmill and a 10-stamp mill, with 850 lb. stamps, run by a 3 ft. Pelton wheel under 360 ft. pressure. The mill works with 6 in. drop, 90 per minute, using No. 40 screens. Parmelee Ore Concentrating Company, of Union Stock Yards, Chicago, Ill., owners.

*Red Cloud Mine* (Quartz).—This claim, 3,000 by 600 ft., is 4 miles N.W. from Igo. It is an E. and W. vein, 8 in. wide, dipping slightly to the N., in granite walls. The quartz carries a large percentage of sulphurets. The ore is sorted and shipped, the first-class ore bringing over \$300 per ton. Developed by a cross-cut tunnel 50 ft. long and turned 50 ft. on the vein, giving about 50 ft. of backs. The freight charges on ore are \$4 to the railroad and \$9 to San Francisco. The gold is worth from \$12 to \$15 per ounce. Hubbard & Kingsbury, of Igo, owners.

*Red Hill Mine* (Hydraulic).—It is half a mile N.E. from Ono, and comprises 60 acres. This gravel belt extends in a S.W. direction, and can be traced for many miles; the underlying granite bedrock has a southerly pitch. The gravel bank averages 60 ft. in depth, carrying about 60 per cent of boulders and cobbles, cemented near bedrock. It carries flat scale gold, worth \$17 50 per ounce throughout, and is richest on the lower 10 ft. The bank has been subjected to heavy movements, as evidenced by slips and faults that have sheared big boulders in two. Both east and west this gravel bed is overlaid with sandstone. The gravel bank is loosened by high explosive powder. The holes are drilled with a 7 ft. worm drill, operated by three men. It takes on an average twenty minutes to put down a 7 ft. hole, which is first "chambered" and then charged with seven sticks of powder.

The source of the water supply is the Dry Creek Tunnel and Fluming Company's ditch. The mine uses 100 in. of water, under 50 ft. pressure, brought through  $1\frac{1}{4}$  miles of ditch, for which they pay from  $3\frac{1}{2}$  to 5 cents per inch, according to the season of the year. The water season lasts ten months. The sluices consist of six boxes, 2 ft. wide, set on a 6 in. grade to the box, paved with wooden blocks 6 in. thick. A clean-up is made every two weeks. For the retaining of the debris, which is dumped into Pan Gulch, there are five brush dams and a stone dam. The latter is 60 ft. long on top and 16 ft. on the bottom;  $12\frac{1}{2}$  ft. thick on bottom and  $7\frac{1}{2}$  ft. thick on top, and is below the others. About 500 in. of water could be obtained for four months in the year, and 100 in. for six months, by digging the necessary ditches. A "giant" with 4 in. nozzles and 450 ft. of 8 in. pipe is used. M. Gardiner, of Ono, owner.

*Remonia Gold Mining Company* (Quartz).—This is 4 miles S.W. of Redding, comprising three claims, known as the *Denver*, the *Colorado*, and the *D & B*. The course of the veins is N.E. and S.W., with a dip of  $60^{\circ}$  W., between granite walls; the width of the veins average  $4\frac{1}{2}$  ft., and are heavily sulphuretted. Developments on the Denver consist of a shaft 45 ft. deep, and two smaller ones 16 and 10 ft. deep; there is a 30 ft. shaft on the D & B vein.

*Richmond Mine* (Quartz).—It is  $3\frac{1}{2}$  miles W. of Igo, and comprises a full claim on a  $2\frac{1}{2}$  ft. vein, coursing N.E. and S.W., and dipping nearly vertical in granite, with 6 to 8 in. width. There are three shafts, 40, 60, and 80 ft. deep, with some drifting. The ore, which carries a large percentage of sulphurets containing silver and gold, is shipped. J. B. Wright, of Igo, owner.

*Sacramento Pliocene Mine* (Drift).—This is in Oregon Gulch, in Sec. 15, T. 31 N., R. 5 W., 5 miles S.W. from Redding, and comprises 1,200 by 1,200 ft. The gravel deposit, 2 ft. thick and 600 ft. wide, lies on a slate bedrock overlaid with about 70 ft. of sandstone. This gravel is dark colored, tight, with large boulders on the bottom; the gold is on and in the bedrock. The property is opened with a perpendicular shaft 6 by 6 ft., 42 ft. deep; from the bottom a drift has been driven E. 125 ft. The mine is supplied with a 25 horse-power upright steam hoist, which has a  $1\frac{1}{2}$  in. Blake suction pump attached, running eight hours per day. The engine consumes one fourth of a cord of oak wood per day. Breasting and washing have not been commenced. Dr. L. A. McLane et al., of Sacramento, owners.

*Salt Creek Group of Mines* (Quartz).—They are on Salt Creek,  $4\frac{1}{2}$  miles N.W. of Redding, and are the following claims: The *Bonanza*, *Corinne*, *Jumbo*, *Gold Coin*, and *Phoenix*.

The Bonanza lies on the west side of the creek, parallel to and 400 ft. distant from the Corinne on the east side. A diorite dike lies between the two, and porphyry forms the opposite walls. These two veins have a N. and S. course and vertical dip. A shaft has been sunk 300 ft. on the ledge, which has an average width of 3 ft., with a gouge on both sides. A short tunnel of 30 ft. has also been run on the vein.

The Corinne, a N. and S. vein, has been exposed by an open cut along the apex. A tunnel 135 ft. long from the west cuts a 4 ft. vein, 20 in. of which carries a large percentage of high-grade sulphurets.

The Jumbo, an E. and W. vein pitching N., crosses the Bonanza and Corinne ledges. A 30 ft. shaft sunk on the vein, dipping W., passed through a pay shoot carrying very coarse free gold. A tunnel on the vein, to intercept the shaft, has been driven 40 ft. In the breast the vein is from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  ft. wide.

The Gold Coin, the first extension southerly of the Corinne, has a 4 ft. vein, with two shallow shafts and 300 ft. of the outcrop stripped.

The Phoenix, east of the Corinne and Bonanza, is a N. and S. vein,  $2\frac{1}{2}$  ft. wide. The ore is disintegrated and carries coarse gold. Ten distinct pay shoots have been determined in these veins, carrying a small percentage of high-grade sulphurets. E. P. Conner, of Redding, owner.

*Schuyler Mine* (Drift and Hydraulic).—It is three fourths of a mile from Igo. The tunnel is 1,900 ft. in length. At 1,500 ft. in is an incline 280 ft. long. The ground is self-draining; the bedrock pitching S.E. Ventilation is secured by three air shafts from 48 to 66 ft. in depth. The breasts are from 30 to 100 ft. wide and carried 6 ft. high, with



single post and cap timbering, also partly rock filled. The hydraulic portion of the claim has a 55 ft. bank, worked with 75 ft. of water pressure, and uses twenty 2 ft. sluice-boxes set on a 5 in. grade, and paved with block riffles. There are two brush restraining dams and one stone dam on Dry Creek for the debris. Chinese Company, owners.

*Scorpion Mine* (Quartz).—See Niagara.

*Shea Mine* (Quartz).—See Niagara.

*Snow Mine* (Quartz).—See Original Quartz Hill.

*South Vein Mine* (Quartz).—See Deakin & Taylor Mine.

*Spanish Vein Mine* (Quartz).—See Deakin & Taylor Mine.

*Sparly Mine* (Quartz).—This claim, 1,500 by 600 ft., is on Flat Creek,  $2\frac{1}{2}$  miles S.W. from Copely. The 7 ft. vein courses E. and W., dipping  $45^{\circ}$  S., and is an extension of the Vanderver & Bullard, with syenite and porphyry walls. A cross-cut driven 450 ft. cuts the ledge, along which the drift has been run 500 ft.; the ground from there to the surface is mostly stoped. Barney Conroy, of Redding, owner.

*Spellman Mine* (Quartz).—This claim, 3,000 by 600 ft., is 3 miles S.W. from Copely. The 2 ft. vein courses E. and W., dipping S., between syenite walls. Developments consist of two tunnels on the vein, from the bank of Spring Creek, about 300 ft. in length. The quartz carries about  $1\frac{1}{2}$  per cent of iron and copper sulphides of good grade. J. Spellman, Joe Mott, and D. Haskell, of Redding, owners.

*Spring Gulch Mine* (Quartz).—This claim, 1,500 by 600 ft., is  $7\frac{1}{2}$  miles N. of Whiskytown. The vein, from 2 in. to 1 ft. wide, courses N. and S., with an easterly dip, in porphyry. Developments consist of three tunnels on the vein, one below another; No. 1, 40 ft., No. 2, 50 ft., and No. 3, 212 ft. long. An upraise from the lower tunnel is at present 40 ft. high. L. Riel and J. R. Woodward, of Stella, owners.

*Storm Mine* (Quartz).—See Original Quartz Hill.

*Sugarloaf Mine* (Quartz).—This is 4 miles W. of Redding, and comprises 20 acres. The 5 in. vein courses a little S. of E., with a vertical dip, between slate and quartzite, to a heavier lode running N. and S. Developments consist of a shaft 22 ft., sunk on the smaller vein, with a small drift. The quartz is mostly specimen rock, carrying some telluride with iron sulphurets, and is worked in a hand mortar. E. D. Hendrick et al., of Redding, owners.

*Summit Mine* (Quartz).—See Niagara Mine.

*Sunny Hill Mine* (Quartz).—This claim, 7 miles W. of Ono, is not being worked at present. The 4 ft. vein courses N. and S., with a vertical dip, between porphyry and slate walls. The ochery ore is sacked and shipped. The ore carries a large percentage of sulphurets. A 5-stamp mill and a 5 ft. Huntington roller mill, belonging to the property, are run by a 4 ft. turbine. The sulphurets are saved on blankets. The ore is hauled to the mill on sledges. Sharp Manufacturing Company, of Ono, owners.

*Surprise Gold Mining and Milling Company* (Quartz).—This claim, 1,500 by 600 ft., is  $1\frac{3}{4}$  miles N. from Shasta City. The 12 ft. vein courses N.  $58^{\circ}$  E., between porphyry walls. A double-compartment shaft, at present 50 ft. deep, has been started in the wall a few feet from the vein. The quartz carries  $1\frac{1}{2}$  per cent of high-grade sulphurets. The mine makes 150 gallons of water per hour. Surprise Gold Mining and Milling Company, owners; J. Gilson, of San Francisco, Secretary.

*Texas Consolidated Mine* (Quartz).—See our Xth Report, p. 629. This is 8 miles N. of Redding, and comprises 519 acres. There are three veins being exploited; the main ledge, which has no outcrop, is about 8 ft. wide, and courses N. and S.; another vein is 380 ft. E., and another 125 ft. W. These have a dip of about  $80^{\circ}$  E., with good slate walls, and with gouge on both sides. The mine is opened by five tunnels, No. 5 being 1,500 ft. long on the vein and 910 ft. below the surface. The ore in the breast carries  $2\frac{1}{2}$  per cent of sulphurets, besides some tellurides. The ore shoot is over 600 ft. in length. An aerial tramway conveys the ore from No. 5 level over  $1\frac{1}{2}$  miles to the 20-stamp mill, on the Sacramento River. The mill contains 825 lb. stamps; a grizzly, with  $1\frac{1}{4}$  in. apertures between bars; a rockbreaker; Hendy self-feeders, working from the center stamp; steel shoes and dies, and both front and back plates inside the battery. The duty of each stamp is 2 tons per day. A small 18 in. apron-plate delivers the pulp through a trap to a double sluice-plate, 18 in. wide and 20 ft. long; these have a grade of  $1\frac{1}{2}$  in. to the foot. Eight improved Triumph concentrators dispose of the concentrates, the tailings passing over a canvas plant of twenty sections, 24 ft. long, set on a grade of 7 in. for the entire length. The final tailings are reported as assaying 25 cents per ton. About 50 men are employed in the mine, and about 75 men through the entire works. The engine is of 50 horse-power, and 5 cords of wood are used per day. E. G. Hart, of Whitehouse, owner.

*Thompson Mine* (Quartz).—This claim, 1,500 by 600 ft., is  $2\frac{1}{2}$  miles S.W. from Shasta City. The course of the 3 ft. vein is a little N. of W. and dips  $50^{\circ}$  N., near the contact of granite and porphyry. An incline shaft, sunk about 80 ft., is intersected by a tunnel run 125 ft. on the vein. The ore is sorted and shipped. See our XIth Report, p. 40. — Thompson, of Shasta City, owner.

*Uncle Sam Gold Mine* (Quartz).—See our Xth Report, p. 629. This is 7 miles W. from Kennett, and comprises seven claims, besides two sections of timber land; employing 67 men in the mine, and 80 men altogether. The vein courses N.  $80^{\circ}$  W. and dips  $55^{\circ}$  N., with a parallel back vein about 100 ft. distant, both in porphyritic rock. The main vein shows a width of 6 in. to 10 ft; the back vein 2 in. to 6 ft. The quartz carries about  $1\frac{1}{2}$  per cent of iron and copper pyrites. The developments consist of several tunnels opening on the vein in different levels. No. 3 is the main working tunnel, from which the ore is conveyed by mule and horse power, five and six cars of  $1\frac{1}{2}$  tons each at a load, over a 1,700 ft. tramway flanking the hillside, to a double incline track 475 ft. long leading to the mill. No. 3 is a cross-cut for 1,200 ft., where it breaks into the vein at right angles and turns east on the vein 800 ft., and west 700 ft.; at the west end it shows 14 ft. of a vein, but is somewhat smaller at the east end. Three shoots have been developed on the main vein, pitching west, and one on the back vein. Three upraises connect No. 3 tunnel with the works above, which show a large amount of reserved ore well opened up. Between tunnels No. 3 and No. 2 the distance on the slope of the upraise is 440 ft.; thence to No. 1, 100 ft.; thence to the surface, 230 ft.

A compressor plant for three drills is operated by water power under 250 ft. pressure, as is, part of the time, the 30-stamp mill and Huntington roller mill with the four Triumph and ten Frue concentrators. The mill averages about 60 tons per twenty-four hours. A 60 horse-power engine runs the mill machinery part of the year.

A peculiar drop of the stamps is found here, being arranged 5, 4, 3, 1, 2, and feeding from No. 2 stamp, being placed a little farther from the end of the mortar than No. 5 at the opposite end. The number of drops is 92, with 5 in. drop and 6 to 7 in. discharge, using Nos. 40 and 45 slot burr screens; aprons have  $1\frac{1}{4}$  in. grade.

A large canvas plant, consisting of two tables, 36 by 20 ft. and 24 by 20 ft., with  $2\frac{1}{2}$  ft. sections, is covered with drilling instead of canvas, and is found to do the work as efficiently. These tables are set on a grade of  $1\frac{1}{4}$  in. to the foot.

The company chlorinate their own concentrates, and have a small double-hearth furnace, with a capacity of 2,400 lbs. in twenty-four hours, using chlorine gas direct and saving the gold only. The elevation at the office of the works is 2,025 ft. English Company, London, owners; W. M. James, of Kennett, Superintendent.

*Utah and California Gold Mine (Quartz).*—It is 7 miles N. of Redding, and comprises 400 acres. The vein, from 3 to 50 ft. in width, courses N. and S. and dips about  $80^{\circ}$  E., in porphyry walls. The ore carries a large percentage of sulphurets. The mine is developed through three tunnels—the Josephine, Emmeline, and Main tunnel. The Josephine is run on the vein and is 900 ft. long. The Emmeline, 70 ft. lower, is partially cross-cutting for 450 ft., then turned both north and south on the vein 700 ft. The Main tunnel is 1,100 ft. in length and 450 ft. below the surface at the breast, with 500 ft. drifted on the vein. An upraise to connect the tunnels is at present all the active work being carried out. Up to date 14,000 tons of ore have been extracted and milled. The ore shoot is 700 ft. in length. On account of the impossibility of extracting anything near the full value of the ore by the present milling process, and the heavy expense connected with the shipping and working of the ores at outside points, no pay ore is at present being stoped.

The company owns a 10-stamp steam mill, 1,400 ft. from the mine, on the Sacramento River, hauling the ore at a cost of 65 cents per ton. The mill is supplied with a No. 1 Blake crusher, Hendy self-feeders, and 1,200 lb. stamps, supplied with chrome steel cams, shoes, and dies; the life of the shoes is 90 days, with a duty of  $2\frac{1}{2}$  tons per stamp per day when working at 90 drops per minute, with  $3\frac{1}{2}$  to 5 in. drop, and 6 in. discharge, through a No. 35 slot-cut Russian iron screen. The batteries are provided with front and back inside plates, and 4 by 12 ft. aprons, set on a  $1\frac{1}{2}$  in. grade to the foot. The aprons, scraped daily, yield an equal amount of amalgam with the batteries. Cyanide of potassium solution and lye are used in the batteries and on the plates. Four Frue vanners save the sulphurets. The mill, when running, consumes 4 cords of wood per day (pine and oak), at a cost of \$4 per cord. Timbers are delivered at 6 cents per running foot. The timbers in the mine do not last over three years.

Artificial ventilation for the main tunnel is supplied by suction, a furnace on the outside drawing the vitiated air through 1,500 ft. of pipe. Water for use in the mill is pumped from the river. Miners' wages are \$2 50 per day; millmen receive \$4. See our Xth Report, p. 630. J. R. and M. H. Walker, of Salt Lake, owners.

*Vanderver & Bullard Mine (Quartz).*—This claim, 3,000 by 600 ft., is  $2\frac{1}{2}$  miles S.W. from Copely. The vein courses E. and W. and dips about  $45^{\circ}$  S., between a syenite hanging-wall and porphyry foot-wall. The



quartz carries 1 per cent of copper and iron sulphides. Developments consist of a cross-cut tunnel 150 ft. to the ledge, and then turned on the course of the vein for 305 ft., giving 100 ft. of backs. Above, on the slope of the hill, two smaller tunnels run to the vein. In connection with the mine is a 3½ ft. Huntington mill, not running, with No. 60 slot screen and a 10 ft. apron 30 in. wide, supplied with a cross riffle every 14 in. Vanderver & Bullard, of Copely, owners.

*Washington Mine* (Quartz).—See our Xth Report, p. 625. It is 4 miles W. of French Gulch, and comprises 82 acres of patented land. There are two systems of veins on the property, a N. and S. and an E. and W.; the walls are porphyry and slate. The N. and S. vein dips 45° E., with a width varying from 1 to 8 ft. on the contact; the ore is low grade, with occasional short shoots of higher-grade ore. The E. and W. veins, of which four are known, are from a few inches to several feet in width and about 60 ft. apart. Timbers cost 5 to 7 cents per foot, and lagging 5 cents apiece. There is a 10-stamp mill with a capacity of 1 ton per stamp. See our XIth Report, p. 635. W. G. Van Meter et al., of French Gulch, owners.

*West End Mine* (Quartz).—This is 1 mile S. of Whiskytown, and comprises 1,500 by 600 ft. There are three veins on the claim; two course N. and S., while the third courses E. and W. The main N. and S. vein is 3 ft. wide, and the smaller one about 12 in., both between porphyry walls. The E. and W. vein is iron capped, about 8 ft. wide. They are sinking a double-compartment vertical shaft 4 by 8 ft. in the wall near the principal N. and S. vein, and is 60 ft. deep at present. Messrs. D. B. Hunt et al., of Stella, owners.

*West Point Mine* (Quartz).—This claim, 1,500 by 600 ft., is 3½ miles from Shasta. The 20 in. vein courses E. and W. and dips 55° N., between a slate foot-wall and a porphyry hanging-wall. Developments are a 40 ft. shaft and a tunnel which will tap the vein at about 160 ft. The hanging-wall side of the vein requires solid timbering. The gold in this section sells for \$18 per ounce. G. W. Boswell, of Shasta, owner.

*World's Fair Mine* (Quartz).—This claim, 1,500 by 600 ft., is 2½ miles N.E. from Igo. The vein, from 3 to 9 ft. wide, courses N. 20° E., dipping slightly W., between slate and porphyry walls. Developed by a tunnel on the vein 130 ft. long, with 100 ft. of backs. The quartz carries a good percentage of sulphurets, largely iron. John Doeblein, of Redding, owner.

*Yellow Jacket Mine* (Quartz).—This claim, 1,500 by 600 ft., is 3 miles N.E. from Copely. The vein courses nearly E. and W., and dips nearly vertical. The walls are syenite and porphyry. The ore is high-grade quartz, carrying galena and iron pyrites. Developments to date consist of an open cut and 50 ft. of a cross-cut tunnel. W. Emerson and W. Slimmer, of Copely, owners.

#### SIERRA COUNTY.

The languishing of the mining industry during the past few years has been perhaps felt more severely in this county than anywhere else within the State, from the fact that only a small portion of its lands are suited for agricultural pursuits, and that the working of the large areas of auriferous gravels was hampered by the law. But aside from these facts, several of the oldest paying mines had reached a point where the

cost of production left too small a margin for profit, and the once extensive works, with their large busy crews, were being managed on a greatly reduced scale. The revival of mining throughout the auriferous belt of California is likewise beginning to penetrate into the mountains and deep cañons of the Sierra; foreign capital is investigating the possibilities of this section, and already some properties have changed hands and are being enlarged and placed on a firmer working basis. That there are still large possibilities for successful mining operations, nobody acquainted with the county and its mining record will dispute.

*Alaska Mine (Quartz).*—This property was mentioned in our VIth Report (Part II), p. 58. It is about one fourth of a mile N.E. of Pike City, and comprises four claims, making 52.88 acres; altitude, 3,800 ft. The vein courses N.E. with a vertical dip, between slate and porphyry walls, and has a width of  $2\frac{1}{2}$  ft. The quartz carries a small amount of low-grade iron sulphurets. The mine has lately been reopened and the intention is to run a deep drain tunnel to lessen the expense of pumping. The present drain tunnel intersects the shaft at a depth of 50 ft.; the new drain tunnel is started from Oregon Gulch and will cut the vein several hundred feet below the shaft, and will be the main working tunnel. Machine drills are to be used, and when completed the mill will be removed to its mouth. Alaska Mining Company, of San Francisco, owners; G. Lux, Secretary.

*Alturas Mine (Placer).*—See our XIth Report, p. 332. It is a tailings claim on Slate Creek, and extends  $5\frac{1}{2}$  miles N. from the La Porte and Port Wine crossing. The average depth of the gravel at present worked is 6 ft., though in places it is over 40 ft. A bedrock cut, one half mile long, has been blasted out, the course of the creek straightened, and extra fall obtained by tunneling through the projecting points; the whole having cost \$20,000. A link-belt elevator is used to raise the gravel; water power, under 100 ft. pressure, acts on a Packer wheel, which is similar to a Pelton. Part of the channel contains rich virgin gravel. The gravel and tailings are washed through a series of boxes set on an 8 in. grade to the 12 ft. box, using cross and slat riffles. There are 25 men employed.

*Atom Gold Mine (Quartz).*—This is 4 miles N.E. from Camptonville, in Lincoln township, and comprises two claims. The vein courses E. of N., standing nearly vertical, between slate and porphyritic walls, with a width varying from 1 in. to 2 ft. The quartz contains a few iron sulphurets and some coarse free gold. The method of working has been confined to washing off the outcrop through sluices and piling up the quartz for future arrastra reduction. For this purpose 400 ft. of sluices are employed, 16 in. wide, with Hungarian riffles; 20 to 50 in. of water from Sleightville Ravine is used under 70 ft. pressure; the season extends over five months. E. C. Cochrane et al., of Camptonville, Yuba County, owners.

*Bald Mountain Extension Mine (Drift).*—See our VIIIth and XIth Reports, pp. 580 and 408. It is  $2\frac{1}{2}$  miles E. of Forest City. The present workings are down channel, requiring the sinking of an incline 130 ft. to a perpendicular depth of 30 ft., and the driving of a gangway on the course of the channel to cut the same, and so work this section up the stream. The water is cut off from the incline in the old works and hauled up in cars, holding 300 gallons each, to the main tunnel; they are loaded with the help of a Chinese pump worked by hand

power. Six cars of water are taken out on a shift. Work will shortly be resumed on the upstream or northern portion of the channel, where a considerable body of gravel remains untouched. It appears that a part of the lava channel runs alongside of the gravel channel, and may have cut through it.

At the head of the incline is a gasoline engine of 6 horse-power for hoisting. A tank of 24x24x8 ft. holds the wash water, and washing is done every time the tank fills. The dump holds several thousand carloads of 1 ton weight each; the present output is 60 cars per day, or 5 cars to each breaster. The head boxes are cleaned weekly, the remainder of the 500 ft. of sluices twice a year. Twenty men find employment around the works. Bald Mountain Extension Drift Mining Company, owners; R. Forbes, of Downieville, Superintendent.

*Bigelow Mine* (Quartz).—See our XIth Report, p. 413. It is a south extension of one of the Sierra Buttes veins, located in Sec. 28, T. 20 N., R. 12 E. The vein courses E. and W. and pitches very flat to the N. A feature of peculiar interest is the intersection of the ledge for a distance of 80 ft. by a lava dike. O. Bigelow, of Sierra City, owner.

*Brandy City Mine* (Hydraulic).—This is in Brandy City, at an elevation of 3,700 feet above sea-level. This channel has been extensively worked in former years. They are at present engaged in building flumes and dams in connection with their impounding works, for which purpose over  $1\frac{1}{2}$  miles of flume will have to be built to convey the debris to the pits where it will be retained. This flume will be 4 by  $3\frac{1}{2}$  ft., set on a 4 in. grade, and will deposit the debris in an old pit closed by a brush dam; the muddy water after settling passes through an old shaft and tunnel in the rim rock, into the North Yuba River. The present bank shows a height of 225 ft., with 50 ft. of lava cap, the gravel being largely composed of small quartz. Under the present contemplated workings only a part of this gravel can be worked. The present water supply is obtained from Cherokee Creek, and is delivered under 225 ft. pressure; they own a water right also on Hoosier Creek, but their flumes have been destroyed. The company own their own sawmill, which is engaged in sawing flume lumber, running night and day. The course of the Brandy City channel, which has been referred to by some parties as part of the Port Wine channel, is from W. to E., and has but little grade in the present pit. The bedrock is slate, and an outlet tunnel has been driven through to Cañon Creek, for which purpose the company used a compressor and two Burleigh drills. The channel averages about 500 ft. in width. The water is conveyed through a pipe reducing from 22 in. to 15 in. and to 9 in., and delivered by three "giants," with  $5\frac{1}{2}$  in. nozzles. The company use rock pavement and block riffles in their flumes; the latter are 22 in. by  $14\frac{1}{2}$  in. and 12 in. thick, costing \$12 per thousand, board measure. The gravel is said to contain platinum. All freight has to be brought from Camptonville by pack animals, costing 1 cent per pound. Wages are \$2 50 per day, and at present 25 men are being employed. Brandy City Hydraulic Mining Company, owners; J. Redington, of Camptonville, Yuba County, Superintendent.

*Bullion (Fessler) Mine* (Quartz).—See our XIth Report, p. 407. It is about 1 mile E. of Alleghany. The vein, supposed to be the same as the Plumbago, is being opened from the Minnesota side of the ridge; it has an E. and W. strike and a N. dip, with porphyry and serpentine walls. Developments consist of several tunnels along the outcrop of the vein.



The quartz carries arsenical pyrites, and is reduced in a hand mortar. J. Fessler, of Alleghany, owner.

*Bunker Hill Mining Company* (Drift).—This is 4 miles N.E. of Brandy City, on the Brandy City and Eureka ridge, and comprises 480 acres. Several tunnels have been run into the ridge by former companies, which are now partially caved. The present company is cleaning out one that starts into the ridge in an N. and S. course at an elevation of 4,450 ft. above sea-level, and it is now in 250 ft. At 100 ft. from the mouth gravel comes into the top of the drift and continues till within 50 ft. of the breast, when the bedrock again raises. This gravel is of a dark color, free, and prospects a little, the gold being of the coarse order and selling at \$17 50 per ounce. Another tunnel, 40 ft. higher, cross-cuts to the gravel, but it is caved. At present one man is washing off the surface near Cherokee Creek below the tunnel, prospecting for evidences of a larger back channel, which is supposed to cross through this ground. On the slate bedrock quartz boulders and coarse gold are found. Bunker Hill Mining Company, owners; H. A. Morse, of Downieville, Secretary.

*Cedar Gold Mine* (Quartz).—It is on Kanaka Creek, in the Alleghany District, and comprises 1,500 by 600 ft., with an E. and W. vein, between slate walls, near the serpentine belt. The pay shoots are short and quite rich where they approach the serpentine. J. Fessler, of Alleghany, owner.

*Chips Mine* (Quartz).—See our Xth and XIth Reports, pp. 652 and 402.

*Cleveland Mine* (Quartz).—This property was described in our Xth and XIth Reports, pp. 650 and 414. The drift is being extended and some prospect work being done. Cleveland Gold Mining Company, owners; J. Kain, of Sierra City, Secretary.

*Clipper Ship Mine* (Drift).—This is about  $1\frac{1}{2}$  miles S.E. from St. Louis. The channel runs N.E. and S.W., with from 2 to 12 ft. of gravel, the pay being confined to the lower half. The front part of the mine was worked as a hydraulic. A tunnel has been driven 1,000 ft. to strike the channel, and an upraise of 8 to 10 ft. it is thought will strike into the gravel. About 800 ft. of the channel has been worked. The tunnel is ventilated by a water-blast; an 11 in. pipe carries the air. Water is obtained from the Sierra Union Water Company, and costs 30 cents per inch per twenty-four hours for hydraulic purposes, and 40 cents per inch for twelve hours for washing the drift gravel in sluices. D. Conlan, of St. Louis, owner.

*Colombo Mine* (Quartz).—See our Xth Report, p. 648. It is 4 miles W. of Sierra City. The property is being worked by tributors, who are drifting between tunnels No. 1 and No. 2 on a fair grade of ore. The ground is much broken and can be worked entirely with the pick; it carries considerable clay. J. A. Roeblin Sons, of Trenton, owners.

*Cortez Mine* (Hydraulic).—See Sailor Boy.

*Craycroft Mine* (Hydraulic).—This claim is on Alabama Hill, 8 miles by trail from Downieville, at an elevation of nearly 6,000 ft., and controls 11 acres. The channel runs N. and S., with a depth of bank of 25 to 30 ft., and no lava capping. The water season lasts three months, taking water from the Hearst & Haggin ditch, issuing from the east branch of the Middle Fork. A hose with a  $2\frac{1}{2}$  in. nozzle is used, with 80 ft. pressure. The sluice tunnel is 300 ft. long, through the rim rock; the flume is 24 in. wide and deep, and paved with rock. The channel

is from 200 to 300 ft. wide; 25 ft. from the bedrock is a layer of big boulders forming an artificial bedrock, on which the best pay is found. The gold is both coarse and fine, and sells for \$18 per ounce. Quick-silver is used in the flume. Twelve men are given work during the season. H. Scamman et al., of Downieville, owners.

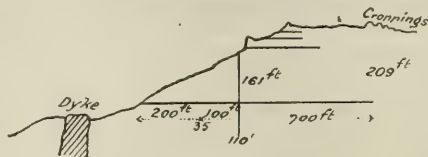
*Depot Hill Mine* (Placer).—It is 5 miles N. of Camptonville, on the Yuba County line, but the works are in Sierra County. The property comprises about 60 acres. The property was formerly worked as a hydraulic claim, the bank being 125 ft. high and all gravel, except a small soil capping. The gravel is small and contains trunks of petrified trees. The course of the channel is N. 28° E., and it is held to be part of the channel that comes from Brandy City through Grizzly and Indian Hill Diggings, but the evidence in this direction is far from convincing. The bedrock has a very flat grade, on account of which a bedrock tunnel is being run up to the old pit, and has a length of 500 ft.; it is at present well timbered throughout, and of such dimensions as to permit the placing of a 30 in. flume below the track when completed, the posts being 8 ft. high placed on sills 5 ft. apart. The water supply comes from the head of Willow Creek through half a mile of ditch, furnishing part of the year 250 in., and all the year 25 in. There are 5,000 ft. of flume, 30 by 24 in., lined with block riffles and set to a grade of from 2 to 2½ in. to the box. The head boxes are cleaned up as occasion demands, but the main flume is only cleaned up once a year. The gold is over .900 fine and about the size of wheat grains. Forty acres of the ground have been worked during the past twenty-seven years; 20 acres still remain. The work is confined to driving the tunnel ahead and cleaning up the bedrock; the latter being slate, slacks down several inches when exposed to atmospheric influences, and can be repeatedly washed off. Small quartz stringers traverse the slate all over, and no doubt, as they carry sulphurets, help to enrich the bedrock. F. Joubert et al., of Camptonville, owners.

*Docile Mine* (Quartz).—This is on the South Fork of Kanaka Creek, 2 miles N.E. from Alleghany, and contains 1,200 by 400 ft. on a N. and S. vein, dipping to the E., in serpentine, with partial slate casings. The vein carries considerable mariposite. The walls are about 4 ft. apart, inclosing from 8 to 18 in. of quartz. The pay shoots are short, carrying a large percentage of arsenical pyrites rich in gold. The development consists of two tunnels, each cross-cutting the vein at a distance of about 450 ft., and then following the vein. The lower tunnel has a length of 1,000 ft. In and below the upper tunnel a short pay shoot developed quite a swell of very rich quartz, but on working down on it the foul air stopped operations. The mine is being worked on a lease. Docile Gold Mining Company, owners; F. Smith, of San Francisco, President; J. Freeborough, of Alleghany, lessee.

*Dreadnaught Mine* (Quartz).—This is in Dreadnaught Ravine, 2 miles E. of Alleghany; it comprises 1,500 by 600 ft. on a N. and S. vein, dipping 72° W., and has a width of 2½ ft., between slate walls. The developments consist of two tunnels, about 40 ft. apart; the lower one is about 500 ft. long; the upper one, which reaches farther on the vein, shows a good-sized vein in the breast, while below it is pinched to a small seam. The quartz carries some sulphurets. A small Kendall 1-stamp mill, run in summer by the water in the ravine, does the crushing. S. S. Crafts & Son, of Alleghany, owners.

*Empire Mine (Quartz).*—This property is in Secs. 25 and 26, T. 21 N., R. 11 E., in Gold Valley, 13 miles E. of Downieville, and is reached by pack trail. The vein courses N. 65° E. and dips 50° S.E.; the walls are partly slate and partly diabase. A heavy dike, striking E. and W., cuts the vein and throws it to the west. The pay shoot, 8 ft. wide, commences near the surface on the south side of the crossing, and pitches to the south, carrying about 6 per cent of sulphurets. Numerous quartz seams make off on the hanging-wall side, and have been followed in some instances.

The developments consist of a main tunnel on the vein 700 ft. long and 209 ft. below the outcrop. At 200 ft. from its mouth a shaft (No. 1) has been sunk 35 ft., and 100 ft. beyond this is a shaft (No. 2) 52 ft. deep, which has been continued upward 161 ft. to the surface. Above the collar of the air shaft is an upper tunnel 200 ft. in length. In the bottom of shaft No. 2, below the main tunnel, is a fine vein 5 ft. wide. The ore is hoisted by windlass, and the arrangements for ventilation are very inadequate. Large sums of money have been expended for the reduction of the ores; furnaces and a chlorination plant, besides a mill (Tustin pulverizer) and a cyanide plant, having been tried at different times, but without effective results. It is the intention to replace all these with a stamp mill. A great hindrance to the working of the mine is the high altitude, over 7,000 ft., with the long winters (six months) and deep snows. G. D. Gray et al., of San Francisco, owners.



SECTION OF EMPIRE MINE, SIERRA CO.

*Excelsior Mine (Drift).*—It is 1½ miles S.E. of St. Louis, and comprises 48 acres. A bedrock tunnel, in hard blue slate, extends 1,400 ft. back into the ridge, but will have to be continued at least 1,500 ft. to tap the Howland Flat and Port Wine channels; a 30 ft. upraise from the tunnel cut into an overflow of gravel 200 ft. wide. The gangways are over 400 ft. long, and come out to the surface on the face of the bank. The main gangway runs S. 42° E. up the middle of the claim; the drifts, run N.E. and S.W., are carried from 3½ to 4½ ft. high. The breasts, 100 ft. wide, are timbered with square sets and lagged. Four to five carloads, weighing a ton each, are breasted out per man. The gravel yields both coarse and fine gold, worth \$19 50 per ounce. The water from the mine is gathered in an old cut, 120 ft. long by 20 ft. deep, and is used for washing once a day. The line of sluices is 60 ft.

long and 14 in. wide; quicksilver is used in the last three boxes, and they are cleaned up after each washing. The lava and pipe-clay capping is from 200 to 300 ft., and the gravel 70 ft. deep. Excelsior Drift Mining Company, owners; W. N. Bissett, of St. Louis, Superintendent.

*Feather Fork (Thistle Shaft) Gold Gravel Company (Drift).*—The property has been described in our XIth Report, pp. 330 and 419, and is situated on the Gibsonville Ridge, 2 miles S. W. from Gibsonville. The shaft is 450 ft. deep. Operations in the former workings have been suspended, and a new station started 20 ft. above,



PLAN OF THISTLE MINE WORKINGS.



and a main gangway run diagonally to the channel, thence 500 ft. N. From this gangway five 60 ft. "runs" start. The present output is 3,000 carloads of 1 ton each, which will be increased in the spring to 8,000 carloads. Seventy men are employed. Feather Fork Gold Gravel Company, of Gibsonville, owners.

*Fessler Mine* (Quartz).—See Bullion.

*Garibaldi Mine* (Quartz).—See our XIth Report, p. 405.

*Gibsonville Water and Nevada Mining Company* (Hydraulic).—This is three fourths of a mile N.E. of Gibsonville, on the north branch of Slate Creek. The work was done on what was supposed to be the front channel of the Gibsonville Ridge. The bank is from 8 to 9 ft. deep, and carries quartz gravel. G. W. Cox, of Table Rock, agent.

*Glidden (Gold Lake) Mine* (Quartz).—This is in Gold Valley, 1½ miles N.E. from the Empire Mine, in T. 21 N., R. 11 E., and is closed down through litigation.

*Gold Bluff Mine* (Quartz).—This property was described in our VIIIth Report, p. 579, and is 1½ miles N.E. of Downieville. It recently changed hands, and the new owners have reconstructed the entire plant. The mill of 20-stamps has been placed on the level of tunnel No. 4, and on account of the lack of space between it and the river, the ore, after passing through the Blake crusher, is hoisted by an elevator to the ore-bin, which has a capacity of 500 tons. The 20 stamps weigh 850 lbs. each, and drop 5 in. 80 times a minute, in the following order: 5, 1, 4, 2, 3, with a 6 in. discharge, through a No. 7 diagonal slot screen. The cams, tappets, and bosses are steel, as well as the shoes and dies. The plating consists of a short battery plate; a 4 by 4 ft. apron, set on a 1¾ in. grade, leading to a quicksilver trap, followed by 6 ft. of plates set on a 1½ in. grade. Below follow four Johnston concentrators, set at 110 strokes, the belt revolving once in seven minutes. The water that passes over the upper end of the concentrator is passed through five boxes below, entering alternately top and bottom and depositing slime sulphurets in each. The tailings from the concentrates are pumped up and passed over a pointed box (Spitzkasten) and a series of drop boxes, before dropping into the river. The water is applied under 275 ft. pressure, acting on a 5 ft. Dodd wheel for the elevator and the rockbreaker, a 6 ft. Dodd for the mill, and a 3 ft. Dodd for the concentrators. The plates are cleaned up every other day, the battery once a month, and the inside battery plate every day. It is claimed that 86 per cent is saved in the battery and only 14 per cent on the plates; and 80 per cent of this latter comes from the battery apron-plate. The tailings are said to assay only a trace. The sulphurets are dried and stored with the intention of erecting a small chlorination plant later. The crushing capacity will likewise be increased as soon as the developments of the mine progress. Gold Bluff Mining Company, owners; W. Kraft, of Downieville, Superintendent.

*Golden King Mine* (Quartz).—See our XIth Report, p. 417. It is 1½ miles E. of Alleghany, and comprises two claims, 2,400 by 600 ft., situated on both sides of Kanaka Creek. At date of visit, tunnel No. 1 had reached a length of 350 ft.; tunnel No. 2, 550 ft., and tunnel No. 3, on the south of the creek, 235 ft. Between No. 1 and No. 2 a perpendicular double-compartment shaft, 4 by 8 ft. in the clear, timbered and plank-lined, has been put down 114 ft. A steam hoisting works and a 4 in. Dow pump are in course of construction. The mine makes 2 in. of

water. A mill site has been graded and a mill will be erected as soon as the hoisting works are completed. The engine is of 15 horse-power, with an upright boiler. Ventilation is secured by a water-blast in the shaft. Twenty-four men are employed. Golden King Mining Company, owners; L. H. Newton, of Alleghany, Superintendent.

*Good Hope Mine (Quartz).*—See Oxford Mine.

*Hanley & Co.'s Gravel Claim (Drift).*—The claim is in French Ravine District, about 3 miles from Alleghany, and comprises 140 acres of patented ground, containing an E. and W. channel, about 400 ft. wide, only 150 ft. of which (that adjoining the south rim) carries pay. The lava capping is 75 ft. deep; the gravel is 50 ft. deep, of the blue character, quartz and slate mixed, carrying 35 per cent of boulders and cobbles, which, on account of the scarcity of available water, are closely sorted out in the mine.

The gold, scattered throughout the lower part of the gravel, is fine and flaky, selling for \$18 75 per ounce. Four tunnels have been run at different levels, but only two were deep enough. The present working tunnel, 6 by 6 ft., has a course N. 25° W. It is run in serpentine the greater distance, but partly in lava and cement. At 1,800 ft. it reaches the channel. The gravel gangway extends up the channel 400 ft., and an estimated length of 4,000 ft. of channel lies beyond. The gravel breasts are carried 40 ft. wide; the drifts are 6 ft. high. In the main tunnel the posts are 6 ft., caps 4 ft. The ventilation in the mine is very imperfect, but this will be remedied as soon as the connection is completed between the two tunnels. From 3 to 4 in. of water issues from the tunnel, and is retained in a reservoir 16 by 20 by 20 ft., for washing. The dump will carry 3,000 carloads; 20 carloads can be washed a day in summer time with 30 ft. pressure through a 2 in. nozzle. The gravel, being cemented, is washed through two strings of sluices with a 25 ft. drop and a bedrock flume between them; the tailings are impounded behind a brush dam, and after two years' slacking are run through a third string of sluices. The sluices are 16 in. wide and 14 in. high, and supplied with cross riffles, blocks, and rocks; the entire length of the sluices is over 600 ft. The head boxes are cleaned up every two weeks, the main sluices every three months. Quicksilver is used in the lower part of the sluices; the gold does not unite with it readily. W. F. Hanley et al., of Alleghany, owners.

*Happy Hollow Mine (Drift).*—See Union Consolidated.

*Hawkeye and Bell Point Consolidated Gravel Mine (Drift).*—It is 5 miles N.E. from Minnesota. The channel courses N.E. and S.W. and is 600 ft. wide, between rims, with from 6 to 18 ft. of gravel, which is white quartz; the pay streak extends 175 ft. across. The gravel is breasted 50 ft. wide on both sides of the gangway, and the drifts are carried from 3½ to 4½ ft. high, timbered with single posts and caps. A breaster takes down 5 carloads per shift. The claim has a width of 800 ft., and extends a mile on the course of the channel. The tunnel is run 400 ft. up the channel, partly in bedrock; about 400 ft. in length of the channel has been worked. The dump holds 3,000 loads, and the gravel is washed from a reservoir 18 by 8 ft., through 120 ft. of sluices 14 in. wide; the boxes are cleaned weekly. The gold is fine and worth \$18 60 per ounce, and is obtained with the aid of quicksilver. Ventilation is effected through air gangways. Water is brought through 1½ miles of ditch from the head of Little Wolf Creek; the season lasts nine months

in the year. In the spring of the year 10 in. of water issues from the tunnel. Martin Mehan et al., of Minnesota, owners.

*Italian Mine* (Drift).—This is at the lower end of Indian Valley, and comprises 5 acres, being 1,000 ft. on the face of the bluff and back to the center of the ridge. The face is 150 ft. deep with 50 ft. of lava capping, 30 ft. of large rocks, and finally quartz gravel cemented on the bottom. The principal pay is next the slate bedrock. A drift has been run in 200 ft. and 10 ft. high. There are no big rocks in the gravel. The gold is worth \$18 75 per ounce.

*Jackson's Claim* (Placer).—This is on the S. side of the North Yuba, 9 miles N.W. of Camptonville. The property consists of 1,500 by 600 ft. along the bank of the river, and a tailings claim up One Horse Ravine. The elevation of the North Yuba River at this point is 2,450 ft. The river bar carries about 25 ft. of gravel, which was partly worked in former times with large returns. The gold is shaped like wheat grains. The channel of the former river here has a N.E. and S.W. course, and is about 120 ft. wide; 200 ft. of the channel has been breasted out to a height of 4 ft., and timbered with posts and caps. The water season lasts about sixty days. E. T. Jackson, of Camptonville, owner.

*Kanaka Mine* (Quartz).—See our XIth Report, p. 404. L. Voss, of Downieville, owner.

*Keystone Gold Mine* (Quartz).—See our Xth and XIth Reports, pp. 653 and 403.

*Lawlor Mine* (Quartz).—See Mount Moriah.

*Lone Star Consolidated Gold Mining Company* (Quartz).—The property was described in our XIth Report, p. 405, and is situated in Gold Valley, in Sec. 25, T. 20 N., R. 11 E., about  $13\frac{1}{2}$  miles E. of Downieville, at an altitude of nearly 7,000 ft. The vein courses N.W. A tunnel has been run 600 ft., cross-cutting a large low-grade quartz vein, and continued beyond to the Lone Star vein, on which it is turned north; the depth gained is only 80 ft. The tunnel is being driven ahead by two men on contract. Lone Star Consolidated Gold Mining Company, owners; J. Weissbein, of Grass Valley, Secretary.

*Lucky Hill Mine* (Drift).—This claim is  $1\frac{1}{2}$  miles S.W. from St. Louis and 3 miles from Scales Diggings, on the ridge between Slate Creek and Big Cañon, and it comprises 640 acres. Two small prospect shafts were sunk, one of which reached the rim gravel. At present a bedrock tunnel is being driven in slate bedrock; it is 200 ft. long to date. C. Hendel et al., of La Porte, owners.

*Lucky Dog Gravel Mine* (Drift).—This is  $1\frac{1}{2}$  miles W. of Forest City, and embraces three locations. A prospect drift running north is in 400 ft., most of the way in bedrock, but the last 100 ft. in lava, with some sand beneath; the bedrock is dipping off to the west. J. Smith, of Forest City, Superintendent.

*Mammoth Springs Mine* (Drift).—This claim is on a ridge between Chip's Flat and the Bald Mountain Extension. At a point facing the creek is an outbreak of gravel, with lava capping, and 40 ft. below this the lower level of the works starts north, but bends around to the west. This tunnel is run 2,000 ft. in bedrock, and upraises of 40 and 60 ft. have been made into barren gravel. About 50 ft. above, farther up the slope of the hill, corresponding to a point 1,200 ft. from the mouth of the tunnel, a second tunnel has been run N.W. about 1,450 ft., mostly in cement, but cutting bedrock 700 ft. from the mouth. From this tun-



nel a shaft 60 ft. deep, near the back end, has been sunk to the gravel below without finding pay. This tunnel is ventilated by a water-blast and air-boxes 8 by 10 in. Mammoth Springs Mining Company, owners; J. Spalding, of Forest City, Superintendent.

*Mercer and Salinas Mine* (Quartz).—See our Xth and XIth Reports, pp. 649 and 413.

*Mining Investment (Mountain Ledge) Company* (Quartz).—The property was described in our Xth Report, p. 647, and is in Sec. 16, T. 20 N., R. 12 E.,  $3\frac{1}{2}$  miles N.E. from Sierra City, and has been shut down some time through litigation; but 9 men have been put on lately to make an upraise from tunnel No. 3 to the pay shoot above, which pitches to the northwest. Mining Investment Company, owners; G. M. Pinney, of Sierra City, manager.

*Mount Fillmore Consolidated Mine* (Quartz).—It is situated on the S. side of Mount Fillmore, 6 miles from Gibsonville. This is a new location. The property contains five claims, with only a little prospect work, which shows a porphyry dike with quartz, coursing a little W. of N. and showing a width of 60 ft. on the surface. The ore body carries a large amount of arsenical pyrites, in places over 30 per cent. C. B. Wingate et al., of Gibsonville, owners.

*Mount Moriah (Lawler) Mine* (Quartz).—This property is in American Hill District, 7 miles N.E. of Minnesota, on Little Wolf Creek, at an altitude of 5,000 ft. There are three claims on the line of the lode, which courses N. and S. and dips  $40^{\circ}$  W. The property has recently changed hands, and is being put in a condition to be worked on an extensive scale. A portable sawmill has been erected, and three tunnels commenced at the N. and S. ends of the claim, and one near the center. No. 1 is 208, No. 2, 250, and No. 3, 300 ft. long. A fourth tunnel is to be started near the south end of the claim, which will cut the vein 1,000 ft. deep, and will be used to deliver the ore direct to the mill, which will contain 40 stamps run by water taken from Wolf Creek, and delivered under 600 ft. pressure. The principal vein crops out near the apex of the ridge for a distance of three fourths of a mile; and a second vein crops out in places below. In driving No. 1 tunnel three veins were cut about 30 ft. apart, varying from 2 to 8 ft. in thickness. The walls are argillite, with a good gouge between. The quartz carries iron and arsenical pyrites, said to assay quite high. The finest kind of timber, including plenty of sugar pine, covers the ground. Twelve men were working, but more were to be added. D. R. McIntosh et al., of San Francisco, owners.

*Mountain Ledge Mine* (Quartz).—See Mining Investment Company.

*Oxford Mine* (Quartz).—This property is in Secs. 22, 23, 26, 27, T. 20 N., R. 10 E., 1 mile N.E. of Downieville, and comprises 6,500 ft. in length on the vein, and a mill site extending down to the North Fork of the Yuba River. The principal vein of the claim is the Good Hope, which courses N.W. and dips  $75^{\circ}$  E., and is on the contact of the slate and serpentine, averaging 4 ft. in width; the serpentine forms the west wall. A good clay gouge is on both sides of the vein. The apex of the ledge on the top of the ridge is at an elevation of 4,475 ft.; the pitch of the hill is about  $40^{\circ}$ , while the main tunnel, starting from the east side of the claim, is at an elevation of 3,400 ft. This tunnel, cross-cutting the slate to the west, reaches the vein at 676 ft., and is continued across it 100 ft. to the serpentine. Prior to reaching the contact, or Good Hope vein,

which is 4 ft. in width, several other strong veins were cut, but not prospected. A drift was turned and run 900 ft. on the Good Hope to the N. W., where a water crossing was cut. From this level to the surface, a distance of 900 ft., no stoping has been done. At an altitude of 3,825 ft. a former tunnel reached the vein and several thousand tons of quartz were extracted; this tunnel was caved at the mouth. No timbering is required in the main tunnel, and ventilation is secured by a water-blast with 11 in. and 5 in. air pipes. Ninety acres of timber land are included in the property, the whole being patented. H. H. Purdy et al., of Downieville, owners.

*Phoenix Gold Mine* (Quartz).—See our Xth and XIth Reports, pp. 653 and 432.

*Pioneer Mine* (Drift).—See our Xth Report, p. 412. It is in Sec. 13, T. 21 N., R. 9 E. The works have been greatly extended in the past season. Several tunnels have been driven on the channel, timbered with 7 ft. posts and 4 ft. caps. The breasts are carried 35 ft., and the breasting timbers are from  $3\frac{1}{2}$  to 5 ft. high. From the mouth of the tunnel to the incline is a distance of 1,063 ft.; a 12 horse-power gasoline engine is placed here to do the pumping and hoisting. The incline is 140 ft. deep on the slope, equal to 35 ft. perpendicular. From the bottom of the incline to the first breast is 94 ft., and the main gangway is extended 200 ft. There are 35 men employed in the mine. A large portion of this mine would pay to hydraulic, which was the former method of working it. Pioneer Drift Mining Company, owners; C. S. Deitem, of Port Wine, Superintendent.

*Plumbago Gold Mining Company* (Quartz).—It is half a mile N. of Minnesota, and consists of two claims, 3,000 by 600 ft. The course of the vein is N.  $75^{\circ}$  E., with a dip  $45^{\circ}$  N. The foot-wall is serpentine and the hanging-wall slate, with an average of 2 feet of vein matter between them. The ledge carries 2 per cent of sulphurets of high grade, mostly arsenical pyrites. The developments consist of two tunnels, 150 ft. apart perpendicularly. No. 1 is 700 ft. and No. 2 300 ft. long; both run to the ledge, and are connected by upraises. From the upper tunnel to the surface there are 170 ft. of backs. A 5 ft. Huntington mill, to be run by steam, is not in working order. Wood is abundant; with a small outlay water can be brought to the mine from Wolf Creek. Working. C. Hegarty, of Moore's Flat, owner.

*Rainbow Mine* (Quartz).—This is in Chip's Flat, and comprises 4,500 by 600 ft. The vein courses E. and W. and pitches N., between slate and serpentine. The developments consist of a tunnel on the mill level on Kanaka Creek, 2,500 ft. long, cross-cutting to the ledge and passing through a stringer at 2,000 ft.; an upraise connects with an upper tunnel 2,000 ft. long. W. F. Hanley et al., of Alleghany, owners.

*Reece Ravine Diggings* (Placer).—This is 3 miles S. from Poker Flat, and includes 100 acres, at an elevation of 5,000 ft. above sea-level. The course of the channel is N. and S. on the Gibsonville and Howland Flat channel. It requires the running of a bedrock tunnel. Snow water is used for washing. J. R. Alexander, of Table Rock, owner.

*Rifle Mine* (Drift).—This is 2 miles S. of St. Louis, in Grass Valley, and comprises 1,000 ft. on the course of the channel. The bedrock tunnel runs 2,000 ft. in slate; 200 ft. back from the breast is an upraise of 12 ft. into gravel 40 ft. thick, carrying gold throughout, though best on the bedrock. About 1,500 ft. from the mouth of the tunnel an air shaft

has been raised 140 ft., all in gravel. The course of the channel is N.E. and S.W. The gangways are timbered with 7 ft. posts, and the breasts are from 25 to 40 ft. wide, filled in 8 ft. back of gangways with bowlders. The gravel is quartz, carrying two distinct qualities of gold; the best sells for \$18 50 per ounce. W. Prosser, of Port Wine, Superintendent.

*Rising Sun Mine* (Quartz).—See our XIth Report, p. 418.

*Rocky Peak Mining Company* (Drift).—It is at Monterey, 4 miles N.E. of Brandy City, on the Brandy City and Eureka ridge, and comprises 700 acres. It is thought that an old, deep river channel passes along the ridge, which, if correct, would seem to be a continuation of the Port Wine channel. It is to tap this channel that this company are running a bedrock tunnel at an elevation of 4,015 ft. above sea-level. The direction of the tunnel is N. 70° W., and it is started along a reef of hard silicious slates. At 180 ft. from the mouth it branches, running in clay and sands with hard slate rim. At the back of the tunnel "bogus gravel" (barren gravel) makes into the top of the drift. A water-blast with wooden air-boxes, 6 in. by 8 in., is run by the water issuing from the tunnel. There is a lava capping on the ridge of at least 240 ft. Near this tunnel the channel is thought to cross through the ridge from the Bunker Hill side of the ridge to the North Yuba side. The tunnel is timbered with 3 ft. 4 in. caps in the clear and 6 ft. posts, with 6 ft. spread. Rocky Peak Mining Company, owners; J. Arnott, of Camptonville, Superintendent.

*Ruby Gravel Mining Company* (Drift).—This property was mentioned in our XIth Report, p. 406. It comprises 440 acres, situated on Rock Creek, into which the tailings dump. As there are three separate channels, with a difference of over 100 ft. in their elevation, the working conditions in the mine are somewhat complex. They all have a general N. and S. course; the center, or lava channel, cuts down through the White Quartz or Bald Mountain channel from the east side, crossing again lower down from the west side. The lowest channel is blue gravel, and is known as the Deep Rock Creek channel, supposed to be a continuation of the one found in Raps Ravine, that passes through the Young American claim near Forest City. The matter of ventilation has received considerable attention. A water-blast, with 50 ft. fall, drives the air into a section of the main tunnel, 8 by 8 ft., which is closely boxed up, and from which an iron pipe 22 in. in diameter extends along the tunnel leading to an air pipe 24 in. square, diminishing to a 13 in. pipe. About 2,200 ft. from the mouth the tunnel forks; also the air pipe. One branch furnishes ventilation to the northern section of the works, the other to the southern. Up to the fork the tunnel was driven with Burleigh drills, at a cost of \$50,000. The timbers in the tunnel consist of 6½ ft. posts, 4 ft. 8 in. caps in the clear, with a 10 ft. spread, each set costing \$1 50. The breasts are timbered with single posts and caps and lagged at the top. The present output is about 50 carloads, of 1 ton weight each, or 5 carloads per shift to the breaster.

A quartz vein has been cut in the tunnel with a N.E. and a S.W. course and dipping W., and has been drifted on both ways; on the south drift a shaft was sunk 30 ft. The quartz, except on the pay shoot, which pitches to the north, has a dry, barren appearance; along the pay shoot it carries free gold and a considerable percentage of iron sulphurets. This point in the mine is 500 ft. below the surface. At



present there are only 27 men at work. Ruby Gold Gravel Mining Company, owners; E. McCormack, of Forest City, Superintendent.

*Russell Hill Claim* (Drift).—This is on Depot Hill, adjoining the Joubert Mine, 5 miles N. from Camptonville, and comprises fifteen 100 ft. square claims. As the property is apparently the same as the rest of Depot Hill deposits, a 125 ft. bank is found with about 20 ft. of pipe-clay on top, and a very small grade to the bedrock; but unlike the other claims, the bedrock is hard and seamy, traversed by a dike, and the gravel, especially near the bedrock, is cemented. The gold near the center of the channel is fine, while along the "vein" it is coarse. The channel is about 150 ft. wide. A drift has been run on the bedrock 200 ft., and 30 ft. breasts opened, carried 6 ft. high. The gold sells for \$18 per ounce. The gravel is washed through 200 ft. of boxes lined with block riffles; quicksilver is used in the flume. Water is obtained from tributaries of Indian Creek through  $2\frac{1}{2}$  miles of ditch, the water season lasting about three and one half months. W. S. Russell et al., of Camptonville, owners.

*Sailor Boy Diggings* (Hydraulic).—These are situated on the Brandy City channel close to Brandy City, and contain 1,000 ft. up and down the ridge. The channel is about 300 ft. wide, and its course here is N.  $32^{\circ}$ . The bank is 75 ft. high, with 30 ft. of capping. The gravel carries gold throughout, although richest near the bedrock, from 4 to 6 ft.; it is scaly and sells for \$19 per ounce. The gravel also carries platinum. The elevation of the bedrock is 3,475 ft. On the bedrock there are extremely large boulders. The water season is about ninety days. The water comes from Cherokee Creek, and is delivered to one "giant" with a 5 in. nozzle, through 300 ft. of 11 in. pipe, under 75 ft. pressure. There are 2,200 ft. of flume in all, 4 by 3 ft., in cross-sections, and paved with rocks, and on a 6 in. grade. The tailings dump into Boise Ravine. The flumes are cleaned up at the end of season. The banks are loosened up in short drifts by the use of giant powder; in places on the bedrock a very hard cement is found. M. Carter, of Camptonville, lessee.

*Scotia and Alice Consolidated Mine* (Quartz).—This is 3 miles S. of Forest City, in French Ravine, and consists of two claims, 300 by 600 ft., joining at an angle. The Scotia is an E. and W. vein, and dips N.; the Alice dips W.; both lie flat in serpentine and have an average width of 1 ft. The quartz shows free gold and carries copper sulphurets. Developments on the Scotia comprise a 75 ft. incline shaft on the vein, and a tunnel 110 ft. long, reaching 8 ft. below the bottom of the shaft. The tunnel is to be continued to the Alice vein. W. H. Smith, of Alleghany, owner.

*Sierra Buttes Mine* (Quartz).—The property has been described in our VIth (Part II), VIIIth, Xth, and XIth Reports, pp. 56, 573, 642, and 402. At present the workings of the mine are confined to the upper levels with a small crew of men. Sierra Buttes Mining Company, owners; S. Thomas, of Sierra City, Superintendent.

*Snowden Gravel Mine* (Drift).—This is in Chip's Flat. A new tunnel is being run to tap a channel 80 ft. wide, lying east of the Blue Lead, but at a higher elevation. The gravel is quartz; bedrock slate. O. Owens et al., of Alleghany, owners.

*South Fork Gold Mine* (Drift).—This claim is in Forest City. A long tunnel has been driven on the S.E. side of the town, parallel with the creek, to cut a channel running N.W., but was diverted from its course

to the east and the channel missed. Later the company worked their property through the tunnel of the Old Bald Mountain Extension, which is situated N.E. of town at the foot of Bald Mountain. The channel has been worked 600 ft. wide. The gold is coarse and is worth \$19 per ounce. Each man breasts out 5 carloads on a shift. W. A. Morse et al., of Downieville, owners.

*Suffolk Gold Mine* (Drift).—This is on the Howland Flat and Port Wine channel; the claim consists of 1,800 ft. along the channel. The course of the channel is north and its width 600 ft. The tunnel runs W. 700 ft., then N. 120 ft., then E. 300 ft., and finally N. 1,000 ft. The first 500 ft. is through the rim rock (slate); thence it follows the channel. Pay gravel is 40 ft. deep, and the breasts are carried 35 ft. wide on each side of the gangway. The timbers of the main tunnel consist of 7 ft. posts and 3 ft. 8 in. caps, with 11 ft. spread; in the gangway the posts are 6½ ft. In the breast single posts and caps are used. An air shaft 322 ft. deep passes through sand, pipe-clay, and lava. The mine furnishes wash water; the reservoirs are 12 by 36 by 8 ft. and 16 by 20 by 8 ft. Each man breasts out 4 carloads of gravel on a shift. Washing is performed every three hours, through 400 ft. of the main sluice line, lined with slat rifles, car wheels, and blocks. Head-boxes are cleaned up every three days. The tailings are dropped into Cañon Creek. Forty men are employed. Feather Fork Gold Gravel Mining Company, owners; D. Moore, of Port Wine, Superintendent.

*Sunset Claim* (Drift).—This is about one fourth of a mile below Good-year's Bar, on North Fork of Yuba River. An incline is sunk on the south bank 25 ft. deep, and a tunnel run under the bar 300 ft. to the east, partly in bedrock. The breasts are carried 6 ft. high; the pay is found on the bedrock. Thirty inches of water are handled with a Chinese pump run by an 8 ft. overshot wheel, 2½ ft. breast, supplied with water from Goodyear's Creek by piping across the river. J. R. Williams et al., of Goodyear's Bar, owners.

*Taber Gold Mine* (Drift).—It is one fourth of a mile S. of Gibsonville, and contains 5,800 ft. on the back line and 1,600 ft. on the front of the Gibsonville ridge. A bedrock tunnel coursing N.W. on a ½ in. grade to the road has been driven from the Slate Creek side 1,300 ft. in lava and 1,150 ft. in a hard silicious slate; the channel is supposed to be 100 ft. beyond. An air shaft 400 ft. deep strikes the tunnel 2,100 ft. from the mouth, showing 170 ft. of bedrock, 30 ft. of barren gravel, 150 ft. of pipe-clay, 9 ft. of blue gravel, and from there to the surface lava. Altitude at tunnel mouth (read by aneroid), 5,560 ft. The dimensions of the tunnel timbers are 6½ ft. posts and 3½ ft. caps, with 6 ft. spread. H. Taber, of Gibsonville, owner.

*Tecumseh (Marguerite) Mine* (Quartz).—See our XIth Report, p. 403.

*Thistle Shaft* (Drift).—See Feather Fork Mine.

*Tough and Hardy Gold Mine* (Placer).—This is 1½ miles E. of Camp-tonville and 300 yds. from the Yuba County line. The property consists of three claims, 4,500 by 600 ft. In following along the bedrock a quartz ledge has been uncovered and cut through by a bedrock drain; it presents a ledge of about 4 ft. in width, with numerous side stringers making into it. The general course of the vein is N. 70° E., with a dip of about 50° W.; the walls are slate and diorite. Except along a shoot of about 150 ft. the quartz appears barren. In the shoot the quartz carries a good percentage of sulphurets of copper and iron. Only surface

developments have been made, but arrangements to sink on the shoot are contemplated. W. B. Meek et al., of Camptonville, owners.

*True Fissure Mine* (Quartz).—See our XIth Report, p. 405. G. Reynolds et al., of San Francisco, owners.

*Union Consolidated (Happy Hollow) Mine* (Drift).—This is usually designated as the Happy Hollow Mine, and lies 5 miles N.E. from La Porte, and comprises five claims (3,900 ft. in length) along the Port Wine channel. The main working tunnel runs 2,050 ft. in bedrock and 700 ft. up the channel, and is connected with an air shaft 275 ft. deep. Tunnel timbers are 7 ft. posts and 3 ft. 8 in. caps, with 11 ft. spread. The gangways are 80 ft. apart, the gravel breast 35 ft. broad and carried 5½ ft. high, timbered with single posts and caps. The gravel (blue quartz) is 10 ft. deep, with a covering of sand. Breasters average 4 cars of 24 cu. ft. each. The amount of cobbles and boulders is estimated at one fifth of the whole. Most of the channel has been worked, but a second channel is believed to cross the property. The gravel is washed through 800 ft. of sluices, 16 by 20 in., supplied with cross-riffles, car wheels, and blocks. They wash once a day with the water stored in a reservoir 24 by 16 by 12 ft., and clean up twice a week. The gold is fine, and worth \$19 25 per ounce. The property is well supplied with spruce and fir timber. At present 10 men are employed in running a branch tunnel. Union Consolidated Drift Mining Company (Limited), owners; G. W. Miller, of Port Wine, Superintendent.

*Watts' Placer Mine* (Drift).—It is situated between the North Yuba River and Big Humbug Creek, 9 miles N.E. from Camptonville, in Lincoln township, and contains 92 acres of patented land and 30 acres held by possessory title. The channel courses N.W. and S.E., with an average width of 250 ft., and a grade of about 55 ft. to the mile. The bedrock is hard; partly slate, partly granitic. The altitude on the bedrock is 3,500 ft., on the top about 3,900 ft., giving about 400 ft. of gravel with soil capping. The gravel is regular river-wash, with a very large percentage of cobbles and boulders, which are mostly piled back into the mine in place of timber. The gold is found near to and in the bedrock, and is coarse. The present works consist of a main tunnel running up the channel for 1,100 ft. on the bedrock (1,000 ft. above present river level), with gangways and breasts, on the east side of the tunnel. On the west side of the main tunnel the bedrock seems to pitch off below the tunnel level toward the North Yuba River, and the ground on that side is untouched. The breasts, are carried from 20 to 50 ft. wide and from 3 to 5 ft. high, very little timber being used. The gravel, though free, stands well. Natural ventilation is secured through connection with an old tunnel. The channel has been excavated 700 by 150 ft. This channel is evidently the former river channel at a higher elevation. A large portion of it could be washed by hydraulicking, as Humbug Creek could be made to restrain the debris with little outlay. Each man on a shift breasts out 4 cars, containing 12 cu. ft. each. J. Watts, of Camptonville, owner.

*Wide Awake Mine* (Drift).—This is situated on Alabama Hill, and comprises 320 acres, supposed to include 1 mile in length on the course of the channel, which is held to be N.W. and S.E. A bedrock tunnel has been run at an elevation of 5,645 ft., N. 70° W., for a distance of 1,400 ft. At 1,000 ft. gravel prospecting 25 cents per ton was struck, when a more westerly course was followed. A branch was carried south



and a short incline sunk into gravel, which was barren. At present a fresh start has been made to the west, now 100 ft. in, with the bedrock in the breast pitching down. A short prospect gravel drift to the north also pitches off fast. The gravel is blue and free. The depth of the gravel, as also the width of the channel, is unknown. The cropping of lava and pipe-clay is about 400 ft. The tunnels are timbered with 7 ft. posts and 3 ft. 8 in. caps, with 9 ft. spread. The breasts are carried 35 ft. wide and  $3\frac{1}{2}$  to  $4\frac{1}{2}$  ft. high; they are timbered with single posts and caps. About 35 cars of gravel are taken out per day, which can be increased as soon as better ventilation is secured by completing connections now under way. For washing, 300 ft. of boxes are used, besides a bedrock flume; slat riffles, car wheels, Hungarian riffles, and rocks are used to pave the bottoms. The boxes are cleaned every Sunday, the bedrock flume in the spring. Wash water is derived from the tunnel and collected in a reservoir 24 by 24 by 6 ft. The washing is done three times a day and once during the night. The gold is coarse; the largest piece found weighed 8 oz. On account of climate, six months' stores have to be laid in. Joseph Brand, of Downieville, Superintendent.

*William Tell Mine* (Quartz).—See our Xth Report, p. 653. Caspar Joos et al., of Sierra City, owners.

*Young America Mine* (Drift).—This claim is at the south end of Forest City. The company owns 250 acres of ground, extending across the ridge down Wet Ravine, a tributary of Kanaka Creek. The channel has a N. and S. course, running across the direction of the present ridge, and has a width of 400 ft. The old works are caved and the present company are driving a tunnel through the slate bedrock from Oregon Gulch; up to date it has attained a length of 450 ft., and will have to be continued 1,200 ft. farther to reach the channel. The ground, which requires no timbering, costs \$7 per foot to drive. Late developments on the opposite side of the ridge indicate the presence of a second channel in the company's ground. B. F. Dickinson et al., of Forest City, owners.

*Young America Mine* (Quartz).—This property was described in our Xth and XIth Reports, pp. 643 and 407, and is doing prospect work at present. Young America Consolidated Quartz Mining Company, owners; T. Brennan, of Sierra City, Superintendent.

#### SISKIYOU COUNTY.

Siskiyou is one of the most northerly counties of the State. In general resources, attractive to secure development and settlement, it compares very favorably with the other mining counties of the State. Aside from its gold mines, its natural resources include a vast area of available timber lands; mineral-water springs of superior quality; large areas of natural pasture; fertile, alluvial valleys, suitable for cereal culture and general farming; still other valleys, of greater altitude, making ideal dairy farms, and localities well suited to the culture of the apple and the pear. In addition to these resources, which have been considerably developed, are possibilities in the way of coal, and building and lithographic stone, that are known but undeveloped. Largely mountainous, and surrounded in every direction by mountain barriers, the desirable section of the county is rendered readily accessible from both San Francisco and Portland by the Oregon and California Railroad. The leading industry of the county is gold mining, quartz, and every description of

placer known, and some not known, in the other mining counties of California. If we *except* river mining, which has had its greatest development on the Klamath River, the mining industry in the development of its possibilities is rather behind the rest of California. This is due to its long years of isolation from the rest of the State before the railroad came in, and not to any lack of richness in the lode and placer deposits. Capital has never gone into this section to any extent until recently, and the lack of newcomers has contributed to keep out improvements in methods and machinery.

Dependent on their own labor and natural resources, mining has had rather more than the average of success as compared with better aided localities. There have been fewer great failures and the mines have a general reputation as fair producers. Better means of communication, a better knowledge of gold-bearing deposits, and better methods of workings, have in the last few years been advancing the extent in territory and yield of the mines. In quartz, the Salmon River country is coming to the front with a number of producing mines, one of which, the Gold Run, gives promise of becoming another Black Bear Mine. A new district, Hungry Creek, close to the Oregon line, has been discovered, and many promising quartz ledges prospected, some of which are developing into profitable mines. The richest placer deposits in the county, those of Yreka Basin, mined in early days only on the edges comparatively, are being reopened, with a return of the old yield to reward the judgment and risk of the men who are doing the work. A distinctly new deposit for California, an auriferous conglomerate, has been identified, and its extent traced for several miles. (See special article and map in this volume.) As a whole, the mining industry is on an excellent basis, remunerative to the miners and contributing to the support and development of the other resources of the county.

*Ahlgrin's Claim* (Hydraulic).—This is 5 miles below Sawyer's Bar, and comprises 40 acres. The bank is from 70 to 80 ft. deep on a former bench of the river. The water is taken from the Little North Fork of North Fork of Salmon River, through  $3\frac{1}{2}$  miles of ditch, and delivered to the giant under 175 ft. pressure. A. Ahlgrin, of Sawyer's Bar, owner.

*Allgood & Casteel Mine* (Placer).—It is on Salmon River,  $4\frac{1}{2}$  miles above Somes' Bar. It is worked by pick and shovel in a small way, as water is scarce. The gravel is 14 ft. deep.

*Allen Mine* (Quartz).—It is in Quartz Valley District. E. Allen, of Oro Fino, owner.

*American Bar Mine* (Placer).—This mine is on the south bank of the Klamath River, not far from the mouth of Shasta River. American Bar Mining Company, owners; J. C. Bayer, of Hornbrook, Superintendent.

*Ampback* (Portuguese, *Fagundez*) *Mine*.—See our XIth Report, p. 432.

*Andrews & Kettlewood Mine* (Hydraulic).—This is near Hamburg Bar, half a mile from the South Fork of Klamath River. M. Andrews and W. Kettlewood, of Hamburg Bar, owners.

*Andrews Mine* (Placer).—This is half a mile below the mouth of Scott River, on the north side of Klamath River. From 30 to 40 men are employed at this mine. M. Andrews and J. T. Miner, of Scott River, owners.

*Andrews & Miner No. 2 Mine* (Placer).—This is about half a mile above Hamburg Bar, in the bed of Klamath River. Messrs. Andrews & Miner, of Hamburg Bar, owners.

*Auberry Mine* (Hydraulic).—This claim is at Cottage Grove, on the north side of Klamath River. R. Auberry, of Cottage Grove, owner.

*Ayles & Dunn Mine* (Placer).—This is on the South Fork of Salmon River, about 7 miles above the "Forks." Geo. E. Fauch et al., of Black Bear, owners.

*Babcock (Santa Ana) Mine* (Drift).—This mine is in Cottonwood District. There are several shafts and tunnels, one of which is 300 ft. in length. H. C. Babcock, of Henley, owner.

*Bailey Mine* (Drift).—It is 6 miles below Seiad, on the north side of Klamath River. M. Bailey, of Seiad, owner.

*Baker Mine* (Hydraulic).—It is on Indian Creek. Geo. Baker & Sons, of Fort Jones, owners.

*Banner Mine* (Quartz).—This is in Quartz Valley District. The developments consist of several hundred feet of tunneling. The vein varies from 1 to 4 ft. in width. H. J. Diggles, of Fort Jones, owner.

*Barnes Mine* (Quartz).—It is in Cherry Creek District. There are three tunnels about 100 ft. in length. Barnes & Co., of Yreka, owners.

*Barry & Co.'s Claim* (Placer).—This is 2 miles from Sawyer's Bar, and comprises 20 acres. It is a low river bar, and has to be worked with derricks. The face of the gravel bank is 14 ft. deep; the pay exclusively in the 6 to 7 ft. next to the bottom. Water is taken from the river. Barry & James, of Sawyer's Bar, owners.

*Beebee Bar Mine* (Placer).—It is on the south side of Klamath River, opposite Lime Gulch. J. Cleland, of Yreka, owner.

*Beebee Bar Mine* (Placer).—This mine is on Scott River, about 2½ miles from Klamath. Chinese Company, owners.

*Bender Mine* (Quartz).—This is on French Creek, a tributary of Scott River. It is stated that the developments consist of a 200 ft. tunnel and other workings, and that the vein shows an average width of 3 ft. F. C. Bender, of Callahan's Ranch, owner.

*Bennett Mine* (Drift).—It is at Scott's Bar. W. Bennett, of Scott River, owner.

*Bennett Mine* (Placer).—This mine is on the west side of Salmon River, about 1 mile below the "Forks." R. H. Bennett, of Forks of Salmon, owner.

*Berton & Litcham Mine* (Placer).—This is about 4 miles below Oak Bar, on the north side of Klamath River. Berton & Litcham, of Oak Bar, owners.

*Big Ben Mine* (Hydraulic).—This mine is in Quartz Valley. Portland Company, owners; S. E. Adams, of Fort Jones, Superintendent.

*Big China Mine* (Placer).—It is on the south side of Klamath River, opposite Empire Bar. Chinese Company, owners.

*Big He Mine* (Quartz).—This claim is on Empire Creek. There is a 180 ft. tunnel. The vein is said to average 4 ft. in width. Sunset Company, owners; Herman Adams, of Henley, Superintendent.

*Big Ledge Mine* (Quartz).—This property is in Quartz Valley District. The developments consist of a 30 ft. incline and a 100 ft. tunnel. The vein varies from 18 in. to 4 ft. H. J. Diggles, of Fort Jones, owner.

*Black Bear Mine* (Quartz).—This is 7 miles south from Sawyer's Bar, and contains six claims. The company employs 45 men. The course of the veins is N.E. and S.W., dip about 35° E., varying in width from 12 in. to 3 ft.; the walls are serpentine and slate. See our VIIIth and



Xth Reports, pp. 620 and 656. Hon. John Daggett, of San Francisco, owner; E. J. Murray, of Black Bear, Superintendent.

*Black Jack Mine* (Drift).—This is about  $1\frac{1}{2}$  miles W. of Hornbrook. The developments consist of several hundred feet of tunneling; the bed, of cemented blue gravel, is about 20 ft. in thickness, and is worked in a custom stamp-mill. W. H. Ritchie, of Henley, Superintendent.

*Blind Lode Mine* (Quartz).—This is in Oro Fino District. There are several tunnels, varying from 100 to 600 ft. in length; the vein is said to vary from 6 in. to 12 ft. in width. H. J. Diggles, of Fort Jones, owner.

*Bloomer Mine* (Hydraulic).—This is on the west side of Salmon River, about 5 miles below the Forks of Salmon. W. P. Bennett, of Forks of Salmon, owner.

*Blue Bird Mine* (Quartz).—It is on Empire Creek. It has a 30 ft. shaft and other workings. J. Randals and B. Griffith, of Hornbrook, owners.

*Boles Mine* (Placer).—This mine is about 4 miles above the mouth of Horse Creek. W. Robertson, of Scott River, owner.

*Bonanza Mine* (Quartz).—It is in Grizzly, a tributary of Indian Creek. The developments consist of three tunnels, each of which is about 300 ft. in length. There is a 5-stamp mill at this mine. H. J. Diggles et al., of Fort Jones, owner.

*Bowersox Mine* (Hydraulic).—It is one fourth of a mile above Somes' Bar, on Salmon River. The water is taken from Somes' Bar Creek by a ditch 1 mile long, 3 ft. wide by 2 ft. deep, on a grade of 2 in. per 12 ft. There are 1,000 ft. of 11 in. pipe, one No. 2 giant with 4 in. nozzle, under 225 ft. head. The creek does not furnish enough water, and a reservoir is now under construction to help out the supply. The bank is 12 ft. high and all gravel. The sluices are 125 ft. long and 20 in. wide; the grade is 11 in. per box, using block riffles. W. H. Bowersox, of Somes' Bar, owner.

*Boye (A B C) Mine* (Hydraulic and Drift).—This is 4 miles S. from Callahans, and comprises 40 acres on Forks Creek. The hydraulic bank carries 25 ft. of gravel. The drift mine is in the river-bed, with about 300 ft. of tunnel and from 12 to 14 ft. breasts, 6 ft. high. On the bedrock are very heavy granite boulders; the bedrock is serpentine and carries coarse, black gold, which is worth \$18 50 per ounce. C. F. Boye, of Callahans, owner.

*Boyle Mine* (Quartz).—This is 7 miles W. of Yreka, in Humbug District. The developments consist of numerous tunnels, some of which are several hundred feet in length. The vein is said to vary in width from a few inches to 3 ft. From 25 to 40 men are employed. The ore is worked in a 10-stamp and also in a roller mill. Haggin & Tevis, of New York, owners; — Boyle, of Yreka, Superintendent.

*Bozza Mine* (Hydraulic).—This is  $9\frac{1}{2}$  miles below Happy Camp, on the south side of Klamath River. J. Bozza, of Happy Camp, owner.

*Brass Wire Mine* (Hydraulic).—It is at Henley. W. H. Smith, of Henley, and A. Harvey, of Yreka, owners.

*Bret, Lacy & Barton Mine* (Placer).—This mine is about 3 miles above the mouth of Horse Creek. Bret, Lacy & Barton, of Oak Bar, owners.

*Brick House Mine* (Placer).—This is on the Forks of Hungry Creek. M. Romaine, of Coles, owner.

*Brown & Billhaps Mine* (Quartz).—It is 4 miles from the mouth of McKenny Creek. They have a 100 ft. tunnel. The vein is 2 ft. wide. Geo. Brown and R. Billhaps, of Walker, owners.

*Brown Bear (Everleth) Mine* (Quartz).—This is 6 miles S.E. from Sawyer's Bar, and comprises three claims. The vein courses N.E. and S.W. and dips about 45° N., between slate and porphyry walls, from 2 to 12 ft. apart. The developments consist of 400 ft. of tunnel, 150 ft. being a cross-cut to the vein. An upraise is being made to the surface for ventilation. The quartz carries a good percentage of iron sulphurets. A 4-stamp mill, run by water power, crushes the ore at the rate of 1½ tons per stamp per day, using No. 9 slot screens. The plates are only scraped once per month; 65 per cent of the amalgam is saved in the battery, which has two inside plates. The gold is .869 fine. F. Golden and T. Everleth, of Sawyer's Bar, owners.

*Brown, George, Mine* (Placer).—It is on the East Fork of Salmon River. George Brown, of Cecilville, owner.

*Brunt, Schorb & Co.'s Mine* (Drift).—This is on Scott River, about three fourths of a mile below Scott's Bar. The developments consist of more than 1,000 feet of tunneling. Brunt, Schorb et al., of Scott's Bar, owners.

*Buckeye Bar Mine* (Placer).—This mine is about 12 miles below Empire Bar, on the south side of Klamath River. Chinese Company, owners.

*Bumble Bee Mine* (Quartz).—This is on Bumble Bee Creek, a tributary of Hungry Creek. There are two 60 ft. tunnels and a 60 ft winze; the vein is 2 to 4 ft. in width. T. Jones and Roberts Estate, of Henley, owners.

*Bunker Hill Mine* (Hydraulic).—It is 13 miles below Happy Camp, on the south side of Klamath River. George Temple, of Happy Camp, owner.

*Burns' Mine* (Hydraulic).—This is in Eddy's Gulch, and 3 miles from Sawyer's Bar. W. Burns, of Sawyer's Bar, owner.

*California Queen Mine* (Quartz).—It is in Cottonwood District. H. Hazlit & Co., of Henley, owners.

*Campbell Mines* (Hydraulic).—These are situated in Quartz Valley District, and comprise a group of locations at the western base of a mountain range which separates the Oro Fino from Quartz Valley. The mines are worked by hydraulic elevators, and about 30 men are employed. The R. H. Campbell Gold Mining Company, of London, Eng., owners; Chas. Roberts, of Etna, resident agent.

*Cannon Mine* (Quartz).—This mine is on the South Fork of the Salmon River, about 6 miles above the Forks of the Salmon. The developments consist of a 60 ft. tunnel and other workings; the vein is about 6 in. wide. J. Cannon, of Black Bear, owner.

*Carl & Shaw Mine* (Quartz).—This is in White's Gulch, about 5 miles from Sawyer's Bar. Carl, Shaw et al., of Sawyer's Bar, owners.

*Cavin Mine* (Placer).—It is on the South Fork of Hungry Creek. A. Cavin, of Coles, owner.

*Centennial Mine* (Placer).—This is at the mouth of Dutch Creek, on the north side of the Klamath River. N. G. Gott et al., of Gottville, owners.

*Chapman's China Claim* (Hydraulic).—This is 3 miles from Callahans, and comprises 20 acres of patented land. The claim is on the

river, with a gravel bank from 50 to 75 ft. high. One "giant," with 2 in. nozzle and a string of 14 in. pipes, is used. The gold is cucumber-seed shaped, and partly black. Chinese Company, owners.

*Chronan Mine* (Placer).—It is on the North Fork of Salmon River, about 5 miles below Sawyer's Bar. Chronan Bros., of Sawyer's Bar, owners.

*Clarey Mine* (Placer).—This claim is in the Cottonwood District. S. Clarey, of Henley, owner.

*Cleland Mine* (Quartz).—It is about 3 miles above the mouth of McKenny Creek. The developments consist of several tunnels about 100 ft. in length, and a 60 ft. shaft. The vein varies from a few inches to 2 ft. in width. F. Cleland, of Yreka, owner.

*Clempner Mine* (Placer).—This property is on Humbug Creek, 2 miles above the mouth of the Little Humbug. —Clempner, of Walker, owner.

*Cole & Barton Mines* (Drift and Placer).—These claims are at Oak Bar, on the north side of Klamath River. H. Barton, of Oak Bar, owner.

*Columbia (Baldy) Mine* (Quartz).—It is 6 miles E. from Scott's Bar. The vein courses E. of N., dips about 35° W., and is 2 ft. wide, between porphyry walls. A 10-stamp mill, run by water power, belongs to the property. R. Denemier, of San Francisco, owner.

*Conzetti Mine* (Placer and Hydraulic).—This mine is on the South Fork of Salmon River, about 7 miles from Summerville. S. Conzetti, of Cecilville, owner.

*Coon Mine* (Hydraulic).—This is 8 miles below Happy Camp, on the north side of Klamath River. Chinese Company, owners.

*Cory Mine* (Quartz).—It is on French Creek, a tributary of Scott River. The developments consist of a 300 ft. tunnel; the vein is about 2 ft. wide. L. H. Cory, of Callahans, owner.

*Crapo Mine No. 1* (Hydraulic).—This property is on both sides of Salmon River, and about 4 miles below the Forks of the Salmon. Chinese Company, owners.

*Crapo Mine No. 2* (Hydraulic).—It is on the west side of Salmon River, about 600 ft. above the river, and adjoins No. 1. Bennett & McLaughlin, of Forks of Salmon, owners.

*Crawford Mine* (Drift).—This mine is at Scott's Bar. Crawford & Co., of Scott's Bar, owners.

*Crocker Mine* (Quartz).—This is in Deadwood District. There are several hundred feet of tunnels. R. E. Crocker et al., of Fort Jones, owners.

*Crooker (Williams' Ferry) Mine* (Placer).—This mine is on an island in the Klamath, about 3½ miles above American Bar. Crooker Bros., of Henley, owners.

*Cummings Mine* (Quartz).—It is on Boulder Creek, 3½ miles S. of Callahans, and is 1,500 by 600 ft. The vein courses N. of E. and dips 60° S., with a width of 2½ ft., between a granite hanging-wall and a serpentine foot-wall. The quartz carries considerable iron sulphurets. J. K. Cummings, of Callahans, owner.

*Davis Mine* (Quartz).—This mine is in Deadwood District, and has a 200 ft. tunnel. L. J. Davis, of Fort Jones, owner.

*Del Norte Mine* (Hydraulic).—This claim is 1½ miles above Happy Camp, on the south side of Klamath River. Richardson & Camp, of Fort Jones, owners.



*Demming & Gardner Mine* (Hydraulic).—This claim is in Oro Fino District. Demming & Gardner, of Oro Fino, owners.

*Dillon's Hill Mine* (Hydraulic).—This is 3 miles below Cottage Grove, on the north side of Klamath River. Chinese Company, owners.

*Doolittle (Daggett) Mine* (Hydraulic).—This claim is 10 miles below Happy Camp, at the mouth of Clear Creek, and on the north side of Klamath River. A. Doolittle, of Happy Camp, owner.

*Dougherty Bros.' Claim* (Hydraulic).—This is 12 m. W. of Sawyer's Bar, on the North Fork of Salmon River, and comprises 20 acres. The bank is 60 to 70 ft. high. One giant and a derrick run by water-wheel are used. Dougherty Bros., of Sawyer's Bar, owners.

*Duncan Mine* (Drift).—This mine is about 5 miles above the mouth of Mill Creek. J. Duncan, of Scott River, owner.

*Duzel Mine* (Placer).—This claim is on Humbug Creek, about 3 miles above the mouth of the Little Humbug. G. A. Duzel, of Walker, owner.

*Eastlick Mine* (Hydraulic).—This claim is in Oro Fino Mining District. Eastlick Bros., of Oro Fino, owners.

*Eastlick & Lewis Mine* (Quartz).—This is in Oro Fino District, and has a 150 ft. tunnel. Eastlick & Lewis, of Oro Fino, owners.

*Elk Creek Mine* (Placer).—It is one mile below Happy Camp, on the south side of Klamath River. J. Camp, of Fort Jones, owner.

*Elliot Mine* (Hydraulic).—This claim is about 25 miles below Happy Camp, on the north side of Klamath River. Elliot Bros., of Cottage Grove, owners.

*Empire Mine* (Quartz).—This is in Empire Creek, 1 mile from Gottville P. O. The developments consist of two tunnels, 100 and 500 ft. long, and a 100 ft. winze. It is provided with a 5-stamp mill run by water power.

*Empire Bar Mine* (Placer).—This property is at the mouth of Empire Creek, on the north side of Klamath River. Geo. J. McCann et al., of Gottville, owners.

*Erno Mine* (Quartz).—This is in Quartz Valley. The developments consist of a 200 ft. tunnel and other workings; the vein is about 1 ft. wide. A. Erno, of Oro Fino, owner.

*Evening Star Mine* (Quartz).—This is on Eddy's Gulch, 7 miles E. of Sawyer's Bar. The vein courses N. of E., with a northerly dip, between slate and porphyry walls, and is from 2 to 6 ft. wide. It is opened by tunnels, and has a 4-stamp mill. J. Daggett and J. S. Doe, of Sawyer's Bar, owners.

*Everill Mine* (Drift).—This mine is about 1 mile below Oak Bar, on the north side of Klamath River. R. Everill, of Oak Bar, owner.

*Everill Mine* (Drift).—This is about  $4\frac{1}{2}$  miles below Hamburg Bar, on the south side of Klamath River. F. Everill, of Hamburg Bar, owner.

*Excelsior Mine* (Hydraulic).—This claim is on the North Fork of Salmon River, about  $3\frac{1}{2}$  miles above Sawyer's Bar. A ditch is being built to furnish water for working the mine. F. Corbin et al., of Sawyer's Bar, owners.

*Fagundez Mines* (Placer).—These claims are on Cherry Creek. They consist of two claims. See our XIth Report, p. 432. A. Fernandez & Co., of Yreka, owners.

*Fagundez Mine* (Quartz).—This is in Eddy's Gulch, about  $2\frac{1}{2}$  miles from Sawyer's Bar. The developments consist of several thousand feet

of tunneling, and the vein averages about 10 in. in width. At this mine there is a 5-stamp mill, which is run by water power. R. Fagundes, of Etna, owner.

*Fairy Queen Mine* (Quartz).—It is on the divide between Empire and Hungry creeks, and is opened by a 160 ft. tunnel. E. McGee, T. Jones et al., of Henley, owners.

*Filley & Woods Mine* (Placer).—This is about 15 miles above the mouth of Thompson Creek. E. Filley and W. Woods, of Seiad, owners.

*Finley Mine* (Hydraulic).—This mine is on the North Fork of Salmon River, about 1 mile from Sawyer's Bar. A ditch is being constructed to furnish water for working the mine. S. M. Finley & Sons, of Sawyer's Bar, owners.

*Foley's Mine* (Hydraulic).—This is 4 miles E. from Callahans, and comprises 20 acres. The bank is 50 ft. high. Water is conveyed through a pipe to a "giant," with a 4 in. nozzle, under 300 ft. head. The tailings pass through 600 ft. of 2 ft. flume, paved with block riffles. The mine is just being opened. Hayes et al., of San Francisco, owners; — Spencer, of Callahans, Superintendent.

*Fort Byers Mine* (Hydraulic).—This claim is on the north side of Salmon River, about  $2\frac{1}{2}$  miles from the "Forks." A ditch is being constructed to furnish water for working the mine. W. P. Bennett and E. McLaughlin, of Forks of Salmon, owners.

*Fort Gough Mine* (Hydraulic).—This claim is about  $5\frac{1}{2}$  miles below Seiad P. O., on the north bank of Klamath River. James Camp, of Fort Jones, owner.

*Fortune Mine* (Drift).—The mine is at Callahans, on Scott River. A. H. Denny and G. Wiker, of Callahans, owners.

*Franks & Moncton Mine* (Quartz).—It is in White's Gulch, about 5 miles from Sawyer's Bar. The developments consist of about a 1,000 ft. of shafts and tunneling, and the vein is about 2 ft. wide. The 5-stamp mill at this mine is run by water power. Franks & Moncton, of Sawyer's Bar, owners.

*Frisby Mine* (Placer).—It is on the South Fork of Hungry Creek. J. Frisby, of Coles, owner.

*Gayhart Mine* (Placer).—This is about  $2\frac{1}{2}$  miles from the mouth of Horse Creek. J. Gayhart, of Oak Bar, owner.

*Gee Wah (Thomas Thomas') Mine* (Drift).—It is on McAdams Creek. Gee Wah Company, of Etna, owners.

*Geeshan & Kellner Claim* (Hydraulic).—This is  $2\frac{1}{2}$  miles below Sawyer's Bar, and comprises 20 acres on a former bench of the river, with a 25 ft. bank of gravel. Geeshan & Kellner, of Sawyer's Bar, owners.

*George Mine* (Placer and Drift).—This claim is on the South Fork of Salmon River, about 8 miles above Cecilville. W. H. George, of Cecilville, owner.

*Gold Ball Mine* (Quartz).—This is between the headwaters of Eddy's and White's gulches, 8 miles E. from Sawyer's Bar, and comprises 4,500 by 600 ft. The vein courses N. of E. and dips  $45^{\circ}$  N., with a width varying from 2 to 8 ft., between slate and porphyry walls. The quartz carries a small percentage of sulphurets. The mine is developed through tunnels, and the ore is crushed in an old style 16-stamp mill. A. Ball et al., of Sawyer's Bar, owners.

*Golden Eagle Mine* (Quartz).—This mine is on Eagle Creek. There are several hundred feet of tunnels and inclines. There is a 5-stamp mill at the mine. F. D. Fraser, of Fort Jones, owner.

*Golden & Everleth Mine* (Quartz).—This is 6 miles E. of Sawyer's Bar, and comprises 1,500 by 600 ft. The vein runs N. of E. and dips about 40° N., between slate and porphyry walls. The mine is developed through tunnels, and a 4-stamp mill reduces the ore. Everleth et al., of Sawyer's Bar, owners.

*Golden Nugget Mine* (Hydraulic).—This is 1 mile N. of Sawyer's Bar, and comprises 136 acres. The bank, all gravel, is 500 ft. high, and is worked by a "giant" with 4 in. nozzle, under at least 100 ft. head. The ground consists of an old river bar and benches, the gravel prospecting throughout. Water is obtained from Eddy's Gulch, and lasts six months. The gold is coarse, cucumber-seed shaped, and sells for \$18 per ounce. Thirty boxes are used, set on a 5 in. grade. S. L. Finley, of Sawyer's Bar, owner.

*Gold Lead Mine* (Hydraulic).—This claim is on Scott River, about 1½ miles below Scott's Bar. H. Andrews, owner.

*Gold Note Mine* (Placer).—This mine is on the north side of Klamath River, about 2 miles above American Bar.

*Gold Run Mine* (Quartz).—It is 10 miles from Forks of Salmon, between the forks of Knownothing Creek. See our XIth Report, p. 429. Hansen & Dannenbrinck, of Forks of Salmon, owners.

*Gordon Mine* (Hydraulic).—This claim is about 7 miles above Happy Camp, on the south side of Klamath River. C. Gordon, of Happy Camp, owner.

*Grant Mine* (Hydraulic).—This is on the west side of Salmon River, about 12 miles below Forks of Salmon. H. Grant, of Forks of Salmon, owner.

*Grattan Mine* (Quartz).—This is 12 miles S. from Sawyer's Bar, and comprises 1,500 by 600 ft. The vein courses N. and S. and dips 45° E., between slate and porphyry walls. The only development is a tunnel on the vein. R. H. Campbell and L. Wagner, of Sawyer's Bar, owners.

*Greenhorn Blue Gravel Mine* (Drift).—This is one fourth of a mile S.W. of Yreka, and comprises 60 acres, 2,904 ft. along the channel, supposed to be the continuation of the Greenhorn Gulch channel, and whose course is N.W. and S.E. The gravel is partly blue, but gray in the upper strata and not cemented; carrying considerable clay and an average amount of cobbles and boulders. The best pay is contained in the 3 ft. next to bedrock; as also a foot or two in the bedrock. The mine is opened by a single-compartment shaft 110 ft. deep, from which a series of branching gangways lead up to the breasts. On the north side of the breasts a shaft is being raised to the surface, which is to be used as the working shaft when completed. The mine required thorough timbering with 4½ ft. posts, 6 ft. caps, and lagging overhead. The boulders and cobbles are all thrown back. About 2 ft. of the bedrock is taken up in drifting and breasting. About 350 ft. of the channel has been worked for 120 ft. in width. A small steam engine of about 10 horse-power runs two Knowles pumps and the hoisting works. The dirt is washed at the mouth of the shaft through a short line of sluices, using Hungarian slat riffles. The engine consumes 1 cord of wood per day, costing \$3 per cord. Timber is delivered unpeeled at the mine for 4 cents per running foot, and lagging 3 cents apiece. The water is derived from Greenhorn Gulch through the Edson ditch, and also from the mine itself. There is sufficient water for washing purposes throughout the year; in winter there is enough to wash bedrock and rewash tailings.



The gold sells for \$17 40 per ounce. A. Lee, of Yreka, owner; A. E. Raynes and T. D. Austin, of Yreka, lessees.

*Grider Mine* (Hydraulic).—This mine is about 10 miles below Hamburg Bar, on the south side of Klamath River. J. Titus, of San Francisco, owner; W. Grider, of Seiad, Superintendent.

*Griffith Mine* (Placer).—This mine is on Hungry Creek. J. Griffith, of Henley, owner.

*Hanson Diggings* (Placer).—This claim is on Salmon River, 4 miles above Somes' Bar. It is said to contain very rich ground, but water is scarce; about 75 in. is collected from Dry Creek, and the gravel is shoveled into the sluices. The mine has lately been sold, and the present owner intends to bring water from Tom Payne Creek by hanging a pipe under a wire cable across the river, which would give him 200 ft. of pressure and water sufficient to supply a giant. The claim contains 20 acres; the gravel is 14 ft. deep. W. H. Bowerson, of Somes' Bar, owner.

*Harrigan Mine* (Placer).—This is about half a mile above Hamburg Bar, on the south side of Klamath River. M. Harrigan et al., of Hamburg Bar, owners.

*Harris Mine* (Hydraulic).—This is on the North Fork of Salmon River, and about 5 miles above Sawyer's Bar. A ditch is being constructed to furnish water. Harris Bros., of Etna, owner.

*Hart Mine* (Placer).—This mine is on Wildcat Creek. C. Hart, of Callahans, owner.

*Hayes Mine* (Hydraulic).—This property is on Wildcat Creek, a tributary of Scott River. G. H. Hayes, of Callahans, owner.

*Heald Mine* (Hydraulic).—This claim is situated about 6 miles below Cottage Grove, on the north side of Klamath River. Oakland Company, owners; C. Lord, of Orleans Bar, Superintendent.

*Heard & Henry Mine* (Placer).—This is in Smith's Gulch Creek, a tributary of the South Fork of Scott River. J. Heard and Jos. Henry, of Callahans, owners.

*Hegler Mine* (Quartz).—This mine is about 6 miles W. of Yreka. The developments consist of three tunnels, varying from 300 to 400 ft. in length, which are connected by upraises. There are several veins from 10 in. to 2 ft. in thickness. The ore is worked in a 10-stamp mill, run by steam power. Hegler Bros., of Yreka, owners.

*Henry Mine* (Hydraulic).—This mine is on Beaver Creek. T. Henry, of Coles, owner.

*Hibernia Mine* (Quartz).—This is on Eddy's Gulch,  $2\frac{1}{2}$  miles S.E. from Sawyer's Bar, and comprises 1,500 by 600 feet. The 18 in. vein courses N.E. and dips  $40^{\circ}$  N., between slate and porphyry walls. The developments consist of a shaft 60 ft. deep and a tunnel run on the vein 200 ft. J. Sallee & Co., of Shasta City, Shasta County, owners; L. Monahan, of Sawyer's Bar, Superintendent.

*Hickey Bros.' Claim* (Hydraulic).—This is  $2\frac{1}{2}$  miles from Sawyer's Bar, and comprises 60 acres. The bench has a 100 ft. bank with 40 ft. of gravel. The water is derived from a neighboring gulch, and the season lasts three months. One "giant" is worked under 200 ft. pressure. Hickey Bros., of Sawyer's Bar, owners.

*H. M. Mine* (Hydraulic).—This mine is on the South Fork of Scott River. Geo. Murray, of Scott River, owner.

*Hoboken Mine* (Quartz).—It is on Cherry Creek. The developments consist of three tunnels, 100, 500 and 700 ft. long. H. J. Diggles, of Fort Jones, owner.

*Hubbard Mine* (Placer).—This claim is on the north side of Klamath River, about  $12\frac{1}{2}$  miles below Empire Bar. J. Hubbard, of Oak Bar, owner.

*Hull's Gulch Claim* (Hydraulic).—See our XIth Report, p. 436. R. H. Campbell Gold Mining Company (Limited), owners.

*Humbug Creek Prospect Workings*.—On Humbug Creek there are numerous small mines and "prospect" workings, which are worked intermittently.

*Hungry Hill (Gold Run) Mine* (Quartz).—This mine is on Know-nothing Creek, a tributary of Salmon River. The developments consist of numerous shafts and tunnels; the vein averages about 2 ft. wide. A. Dennenbrienk, of Gilta, owner.

*Hunter & Dowey Mine* (Quartz).—It is between the North Fork of Salmon River and White's Gulch, and about 5 miles from Sawyer's Bar. H. Hunter and L. Dowey, of Sawyer's Bar, owners.

*Indian Girl Mine* (Quartz).—This claim is about 9 miles from Hornbrook, on the north bank of Klamath River. The vein is exposed by an open cut 200 ft. long and 10 ft. deep. J. Prince, of Henley, owner.

*Ironsides Mine* (Quartz).—This is in Cherry Creek District, and is developed by tunnels 80 and 150 ft. long and shafts from 30 to 80 ft. in depth; the vein averages 15 in. wide. James Ironsides et al., of Yreka, owners.

*Jackson Mine* (Placer).—It is on Little Humbug Creek, about 3 miles from its mouth. B. B. Jackson, of Walker, owner.

*Jennie Mine* (Quartz).—This is in Riverside District. There are two 60 ft. tunnels. A. Haines and Geo. Hosseck, of Walker, owners.

*Jensen, Geo., Mine* (Placer).—This mine is about 3 miles above the mouth of McKenny Creek. Geo. Jensen et al., of Oak Bar, owners.

*Jerry Lane Mine* (Placer).—This property is  $10\frac{1}{2}$  miles below Happy Camp, on the north side of Klamath River. Jerry Lane, of Happy Camp, owner.

*Jillson Blue Gravel Mine* (Hydraulic).—This claim is in Cottonwood District, about 20 miles N. of Yreka. See "Auriferous Conglomerate" in this volume. C. B. Jillson et al., of Henley, owners.

*Johnson Mine* (Placer).—This mine is 6 miles above the mouth of Horse Creek. — Johnson, of Oak Bar, owner.

*Johnson Mine* (Quartz).—This is in the Oro Fino District. The developments consist of several hundred feet of tunneling, and the vein shows a thickness of from 4 in. to 3 ft. Johnson Estate, owner; J. Moxley and Chas. Jenner, of Etna, agents.

*Jumbo Gold Mine* (Quartz).—This is 6 miles from Sawyer's Bar, between the headwaters of Eddy's and White's gulches, and comprises 6,000 by 600 ft. The vein courses N.E. and dips  $45^{\circ}$  N., between slate and porphyry walls, with a width varying from 3 to 8 ft. The quartz is low grade, with a small percentage of sulphurets. There is a 10-stamp mill on the property. The mine is being developed through tunnels. Dr. A. C. Helm and H. J. Eldridge, of Sawyer's Bar, owners.

*Junction Bar Mine* (Placer).—This is at the mouth of Scott River. Lang & Co., owners.

*Keaton Mine* (Placer).—This mine is on Hungry Creek. T. J. Keaton, of Henley, owner.

*Kettlewood & Tibbets Mine* (Placer).—This claim is about  $3\frac{1}{2}$  miles above the mouth of Seiad Creek. W. Kettlewood and F. Tibbets, of Seiad, owners.

*Klein's Claim* (Hydraulic and Drift).—This is in the vicinity of Sawyer's Bar, and comprises about three fourths of a mile of the river. The bank is 60 ft. in height; the drifting is carried out on a lower bar and extends 150 ft. Water is obtained from Jessup's Gulch, and lasts five months in the year. A derrick and one giant are used. W. E. Klein, of Sawyer's Bar, owner.

*Knownothing Mine* (Quartz).—This mine is on Knownothing Creek, a tributary of Salmon River. The developments consist of three tunnels, the longest of which is about 1,000 ft. in length. The vein varies in thickness from a few inches to 3 ft. W. P. Bennett and L. Bevan, of Forks of Salmon, owners.

*Lain Mine* (Hydraulic).—This is  $3\frac{1}{2}$  miles below Hamburg Bar, on the south side of Klamath River. Lain Bros., of Hamburg Bar, owners.

*Lange Mine* (Hydraulic).—This mine is on Barkehouse Creek. Nelson Lange, of Barkehouse, owner.

*Lango Mine* (Quartz).—This claim is on Barkehouse Creek, about 16 miles W. of Yreka. The developments consist of numerous tunnels and shafts; the vein is about 1 ft. wide. There is a 5-stamp mill run by water power. J. S. Cleland, of Yreka, owner.

*Last Chance Mine* (Drift).—This is one fourth of a mile north of Callahans, and comprises 20 acres of patented land. The work is carried on in the bed of the river; the gravel is about 50 ft. deep. A shaft had been sunk and 50 ft. drifted on the bedrock, when the water broke in. The gold on the bedrock is coarse. The gravel contains gold throughout, and pays \$4 a day to the man. Denny, Flak et al., of Callahans, owners.

*Last Chance (Lindsey) Mine* (Quartz).—This mine is in Oro Fino District. The developments consist of a 300 ft. tunnel and other workings; the vein is said to be 6 to 18 in. in width. R. S. Lindsey, of Oro Fino, owner.

*Lee Mine* (Hydraulic).—This claim is at the mouth of Seiad Creek, on the north bank of Klamath River. Chinese Company, owners.

*Lee Moy Mine* (Placer).—This is on the south side of Klamath River. Lee Moy & Co., of Gottville, owners.

*Leonard Mine* (Placer).—This consists of two claims situated about 6 miles below Oak Bar, in the bed of the Klamath River. W. Leonard, of Oak Bar, owner.

*Liberty Mine* (Quartz).—It is in Eddy's Gulch, about 5 miles from Sawyer's Bar. J. S. Hughes et al., of Sawyer's Bar, owners.

*Lime Gulch Mine* (Placer).—This claim is on the north side of Klamath River, at the mouth of Lime Gulch. Chinese Company, owners.

*Little Humbug Mine* (Placer).—This is at the mouth of Little Humbug Creek. B. B. Jackson, of Walker, owner.

*Live Yankee Mine* (Quartz).—See our XIth Report, p. 432.

*Low Mine* (Placer).—It is on the south side of Klamath River, about 6 miles above American Bar. W. Low, of Henley, owner.

*Lowden Mine* (Hydraulic).—This claim is about 3 miles below Hamburg Bar, on the south bank of the Klamath River. J. S. Lowden, of Hamburg Bar, owner.

*Lowden Bros.' Mine* (Placer).—This claim is on Seiad Creek, about 3 miles above its mouth.

*Lucky Baldwin Mine* (Drift).—This is near Callahans, and is a river claim of 1,500 ft. in length and 450 ft. wide. The gravel bank is about 50 ft. deep. A. H. Bar and P. Holden, of Callahans, owners.



*Lucky Bob Mine* (Hydraulic).—This mine is at Empire Bar, on the north bank of the Klamath, and about 100 ft. above the river. M. Freshour, of Gottville, owner.

*Luke Shaw Mine* (Drift).—This property is about 4 miles S. of Hooperville, on Indian Creek. There is said to be a drainage tunnel at this mine which is more than a mile in length. Chinese Company, owners.

*Mabel Mine* (Quartz).—This is 7 miles E. from Scott's Bar, and comprises one claim. The vein courses E. of N., with a dip of 35° W., between porphyry walls 2 ft. apart. W. A. Chamberlain, of Yreka, owner.

*Maloney Mine* (Hydraulic).—This mine is on the North Fork of Salmon River, about 3 miles below Sawyer's Bar.

*Maplesden Mine* (Hydraulic).—This claim is 3½ miles below Hamburg Bar, on the north side of Klamath River. W. Maplesden, of Hamburg Bar, owner.

*Maplesden Mine* (Drift).—This is at Hamburg Bar, on the south side of Klamath River. Maplesden & Sons, of Hamburg Bar, owners.

*Martin Andrews Mine* (Drift).—This is at Scott's Bar, on Scott River. W. Bennett, of Scott's Bar, owner.

*Mathewson Mine* (Quartz).—This is in Cherry Creek District. The developments consist of an 80 ft. and a 150 ft. tunnel, and shafts from 30 to 80 ft. in depth; the vein shows an average width of about 15 in. James Ironsides et al., of Yreka, owners.

*McCauley Mine* (Drift).—This claim is on Scott River, about 3½ miles above its mouth. The developments consist of a 200 ft. tunnel. James McCauley & Son, of Scott's Bar, owners.

*McCoy Mine* (Placer).—This mine is on Hungry Creek, and is owned by M. Romaine, of Coles.

*McCreay & Maplesden Mine* (Hydraulic).—This mine is about one fourth of a mile above Hamburg Bar, on the south side of Klamath River. R. McCreay and B. F. Maplesden, of Hamburg Bar, owners.

*McGuffy & Falkenstein Mine* (Drift).—This mine is at Scott's Bar. G. McGuffy and Lewis Falkenstein, of Scott's Bar, owners.

*McMahon's Claim* (Drift).—This is a river claim, one fourth of a mile from Callahans, with 300 ft. front, running back 200 ft. into the ridge. There is a tunnel 750 ft. long, with 12 ft. of a gravel breast; the gravel is 25 ft. high. The bedrock is swelling serpentine. From 8 to 10 tons of gravel, said to be of high grade, are taken out per day. J. W. McMahon, of Callahans, owner.

*McNeal Mine* (Hydraulic).—This claim is on the east side of Salmon River, and about 4½ miles below Forks of Salmon. George McNeal, of Forks of Salmon, owner.

*McNeal's Bar Mine* (Hydraulic).—It is at Forks of Salmon, and on the south side of the river. W. P. Bennett, of Forks of Salmon, owner.

*Metropolitan Mine* (Quartz).—This mine is in White's Gulch, about 4 miles from Sawyer's Bar. It is stated that the developments consist of a 200 ft. tunnel; also that there are two veins in this mine, both of which are about 4 ft. in thickness. A. Parker and others, of Etna, owners.

*Midwinter Mine* (Quartz).—It is on the south side of Klamath River, about 8 miles from Hornbrook. The developments consist of a 60 ft. tunnel and other workings. There are three other tunnels situated not

far from this, which are owned by the company. W. B. Edmondson & Co., of Henley, owners.

*Milich Mine* (Hydraulic).—This property is on the east side of Salmon River, about  $4\frac{1}{2}$  miles below Forks of Salmon. P. Milich, of Forks of Salmon, owner.

*Milligan's Bar Mine* (Hydraulic).—This claim is about 17 miles below Happy Camp, on the north side of Klamath River. B. Goodwin, of Happy Camp, owner.

*Missouri Bar Mine* (Placer).—This mine is on the South Fork of the Salmon River, about 2 miles above the "Forks." W. P. Bennett, of Forks of Salmon, owner.

*Montez Mine* (Hydraulic).—This is on Salmon River, about 5 miles from its mouth. Clark et al., of Somes' Bar, owners.

*Montezuma Mine* (Hydraulic).—This is half a mile S. from Callahans, and comprises 40 acres. The claim is a part of a river bed, with a 20 ft. bank of gravel, on the South Fork of Scott River. The gold is both coarse and fine; the former lies near the bedrock. The gold sells for \$17 50 per ounce. Twenty-two men work in the claim. Chinese Company, owners.

*Montezuma Hill Mine* (Hydraulic).—This claim is 14 miles below Happy Camp, on the north side of Klamath River. H. Gasquet, of Del Norte, owner.

*Moore & Descher Claim* (Drift).—This is 3 miles below Sawyer's Bar, and comprises 20 acres. The property is on a former bench of the river, the bank being 100 ft. high, with 12 ft. of gravel. The developments consist of a 150 ft. tunnel, with 40 ft. of gravel breasts carried 6 ft. high, timbered with post and cap. Twelve carloads of gravel, of 1,500 lbs., are extracted per day. The gold is worth \$17 50 per ounce. G. A. Moore and J. Descher, of Sawyer's Bar, owners.

*Mountain Belle Mine* (Quartz).—It is 1 mile up from the junction of Eliza Fork with North Fork of Humbug Creek. See our XIth Report, p. 444. Cartwright & Phillips, of Yreka, owners.

*Mountain Lion and Ohio Mines* (Quartz).—These mines are about 5 miles from Hornbrook, on the north side of Klamath River. There are two 50 ft. tunnels and various open cuts. W. A. Jacobs and J. Thompson, of Ashland, Oregon, owners.

*Mount Sterling Mine* (Placer).—This is on Mount Sterling, and about 18 miles W. of Coles. P. Flett, of Coles, owner.

*Muck-a-Muck Mine* (Hydraulic).—This claim is about 5 miles above Happy Camp, on the north side of Klamath River. Mrs. M. Reeve, of Happy Camp, owner.

*Myers Mine* (Placer).—This is about half a mile below Hamburg Bar, and on the south side of Klamath River. W. F. Myers, of Hamburg Bar, owner.

*Myers & Smith Claim* (Drift).—This is half a mile from Sawyer's Bar, on the north side of Salmon River, and comprises 40 acres of patented land. The ground, which is a high bar, is nearly worked out. Myers & Smith, of Sawyer's Bar, owners.

*Nave & Green Mine* (Placer).—This mine is on Hungry Creek. J. C. Nave and W. Green, of Henley, owners.

*Neft & Sons Mine* (Placer).—This claim is about  $3\frac{1}{2}$  miles above the mouth of Horse Creek. Neft & Sons, of Oak Bar, owners.

*Nelson Mine* (Quartz).—See our XIth Report, p. 446.

*New York Mine* (Quartz).—This is at Hooperville, on Indian Creek. The developments consist of a 600 ft. tunnel and other workings; the vein is from 1 to 8 ft. wide. E. W. Miller, of Fort Jones, owner.

*Nicklet Mine* (Quartz).—This mine is on Rattlesnake Creek. The developments consist of 500 ft. of tunneling; the vein averages 8 in. in width. C. Nicklet, of Sawyer's Bar, owner.

*Nigger Hill Mine* (Hydraulic).—This claim is on the South Fork of Salmon River, about  $2\frac{1}{2}$  miles above Forks of Salmon. W. P. Bennett, of Forks of Salmon, owner.

*Nolan Mine* (Placer).—This mine is on the South Fork of Scott River. E. Nolan, of Callahans, owner.

*Nolan's Bar Mine* (Hydraulic).—This mine is about half a mile below Cottage Grove, on the south side of the Klamath. H. Thomas, of Cottage Grove, owner.

*North Star Mine* (Quartz).—See Boyle Mine.

*Nuggett Bar Mine* (Placer).—It is on the South Fork of Salmon River, about 8 miles above Forks of Salmon. Alex. Parker & Son, of Etna, owner.

*Oak Grove Mine* (Drift).—This is on McAdam Creek. J. A. Lincoln and M. Finley, of Fort Jones, owners.

*Ock Mine* (Hydraulic).—This claim commences about  $2\frac{1}{2}$  miles below Happy Camp, and extends up the northern bank of the river for a distance of about 3 miles. Chinese Company, owners.

*Old Buckeye Bar Mine* (Placer).—This mine is on McKenny Creek. A. Jackson, of Walker, owner.

*Old Fort Jones Mine* (Placer).—It is on the north side of Klamath River, about a quarter of a mile below Empire Bar. Chinese Company, owners.

*Old Kanaka Mine* (Hydraulic).—This claim is on Virginia Bar, on the north side of the Klamath. Geo. Simmons, of Hawkinsville, owner.

*Olive Mine* (Quartz).—This is at Hooperville, on Indian Creek. The developments consist of two 300 ft. tunnels. J. W. Smith, of Fort Jones, owner.

*Olsen Claim* (Hydraulic).—This is on the North Fork of Salmon River, 9 miles below Sawyer's Bar, and comprises 20 acres. The bank is 70 to 80 ft. high, carrying 15 ft. of gravel. The water is derived from a neighboring gulch; the season is short. One giant and a 2 ft. flume are used. Fred Olsen, of Sawyer's Bar, owner.

*Oregon Bar Mine* (Placer).—This mine is on the north bank of Klamath River, about half a mile above the mouth of Shasta River.

*Oregonian Mine* (Quartz).—This is 3 miles N.E. from Sawyer's Bar, in Rattlesnake Gulch, and comprises four claims. The vein courses E. and W., dips  $40^{\circ}$  N., and is from 6 to 8 in. wide, between granite walls. Henry H. Hunter, of Sawyer's Bar, owner.

*Osceola Mining Company* (Quartz).—This is 7 miles E. of Sawyer's Bar, and comprises 3,000 by 600 ft. The vein courses N.E., but has not been struck yet in the tunnel. There is a 5-stamp mill on the property.

*Patterson Mine* (Hydraulic).—This claim is on Beaver Creek. Patterson Bros., of Coles, owners.

*Peters' Mine* (Quartz).—This is in White's Gulch, about 6 miles from Sawyer's Bar. Peters Bros., of Sawyer's Bar, owners.

*Phillips & Cartwright Mine* (Quartz).—This mine is 8 miles W. of Yreka. The developments consist of three tunnels, varying from 200 to



300 ft. in length, and a 300 ft. incline. Phillips & Cartwright, of Yreka, owners.

*Phillips Mine* (Placer).—This is about 4 miles above the mouth of Seiad Creek. B. Phillips & Son, of Seiad, owners.

*Phil Mott Mine* (Placer).—This mine is about half a mile below Empire Bar, on the north side of Klamath River. Chinese Company, owners.

*Pierson, Jack, Mine* (Placer).—This claim is on Little Humbug Creek, about 1 mile above its mouth. J. Pierson, of Walker, owner.

*Pierson Mine* (Placer).—This is on Humbug Creek. H. White, of Walker, owner.

*Pitts Mine* (Quartz).—This property is in the Oro Fino District. The developments consist of a 200 ft. tunnel; the vein varies from 2 in. to 1 ft. in width. J. Pitts, of Oro Fino, owner.

*Pollard Claim* (Drift).—It is a short distance from Callahans, on the South Fork of Scott River, with 900 ft. face and running back into the hill. The working tunnel is between 600 and 700 ft. long; breasts 100 ft. long and 6 ft. high. The channel has the same course as the river, and is 12 ft. wide. Next to the bedrock the gravel is cemented and contains coarse black gold. Jacob Pollard, of Callahans, owner.

*Pool Mine* (Quartz).—This is on Hungry Creek. There is a 180 ft. tunnel. C. B. Poole et al., of Henley, owners.

*Portuguese Bar Mine* (Hydraulic).—This mine is about 5 miles below Seiad, on the north bank of the Klamath. Jas. Camp, of Fort Jones, owner.

*Preckel Mine* (Hydraulic).—This claim is on Sawmill Creek, about one fourth of a mile from Scott's Bar. H. Preckel, of Scott's Bar, owner.

*Prince Consort Mine* (Quartz).—This is in Cottonwood District. Developments consist of a 180 ft. tunnel. Herman Adams, of Henley, agent.

*Providence Mine* (Quartz).—This mine is situated in the Oro Fino District. The developments consist of a 300 ft. tunnel; the vein has an average width of 16 in. Carson & Cradle, of Oro Fino, owners.

*Quartz Hill Mine* (Hydraulic and Quartz).—This is in Scott's Bar District, about 14 miles W. of Yreka, at an elevation of 400 ft. above the river. The surface paid well to hydraulic, while beneath large bodies of quartz have been exposed, that are being worked. There is a 10-stamp mill on the property, run by steam and water power. See our XIth Report, p. 447. Quartz Hill Mining Company, of San Francisco, owners; — Humphries, of Scott River, Superintendent.

*Quigley Mine* (Placer).—This is situated on Beaver Creek, about 5 miles from its mouth. W. Quigley, of Walker, owner.

*Ramus Mine* (Placer).—This mine is on Scott River, about half a mile above its mouth. J. Ramus, of Scott River, owner.

*Red Hill Mine* (Hydraulic).—This is at Gilta, between the South Fork of Salmon River and Knownothing Creek, and comprises 160 acres. The pit has a 30 ft. bank 200 ft. long, with 12 ft. of gravel next the bedrock, with soil capping. It comprises both a bench and a back channel. Water is obtained from Knownothing Creek, through 3 miles of ditch, carrying 1,500 in. of water, which is delivered through several thousand feet of 15 in. and 11 in. pipe to two giants, using  $4\frac{1}{2}$  in. nozzles, under a pressure of from 250 to 300 ft. The best pay is in the 3 ft. of gravel next to the bedrock. The dump is 100 ft. down into the river.

There are two flumes, consisting of 90 and 80 boxes 3 ft. wide, set on a grade of  $4\frac{1}{2}$  and 6 in., which are cleaned up once a month, the gold being worth \$17 75 per ounce. The company own a sawmill; timber is plentiful. Parker Bros., of Etna, owners.

*Reeves, J., Mine* (Hydraulic).—This mine is about 8 miles above Happy Camp, on both sides of the Klamath River. See our XIth Report, p. 443. Joe Reeves, of Happy Camp, owner.

*Reider Mine* (Quartz).—This mine is on the south side of Klamath River, about 8 miles from Hornbrook. The developments consist of an open cut 200 ft. long and 10 ft. deep. J. Prince et al., of Henley, owners.

*Reliable Mine* (Quartz).—It is in the Hungry Creek District. There are two tunnels 30 and 175 ft. long. J. L. Coyle, of Hornbrook, owner.

*Rider & Fabricius Mine* (Placer).—This is on Hungry Creek. Rider & Fabricius, of Walker, owners.

*Rhinebold Mine* (Placer).—This mine is situated on the East Fork of Salmon River. J. J. Rhinebold, of Cecilville, owner.

*Roberts Mine* (Quartz).—This claim is in Eddy's Gulch, about 5 miles from Sawyer's Bar. E. Roberts, of Sawyer's Bar, owner.

*Robinson Mine* (Placer).—This is about 6 miles above the mouth of Scott River. J. Robinson, of Scott River, owner.

*Robinson Mine* (Placer).—This mine is about 4 miles above the mouth of Horse Creek. W. Boles, of Oak Bar, owner.

*Santa Teresa Mine* (Quartz).—This mine is on Hungry Creek, and has a 10-stamp mill. Staples, Moore & Co., San Francisco, owners.

*Sauerkraut Mine* (Hydraulic).—This property is on the east side of Salmon River, about 5 miles below Forks of Salmon. Chinese Company, owners.

*Saxild Mine* (Placer).—It is 3 miles above the mouth of Dutch Creek. J. Saxild, of Gottville, owner.

*Schroeder Mine* (Quartz).—This mine is in Deadwood Creek, about 7 miles W. of Yreka. It embraces a group of five or six locations. The developments consist of several tunnels and stopes, in all several thousand feet of work. At this mine there are said to be several veins, which vary from 3 to 20 ft. in width. Thirty-five men are employed. There is a 10-stamp mill and two Frue concentrators. J. H. C. Schroeder, of Yreka, owner.

*Scott's Mountain (Crawford) Mine* (Placer).—This mine is on the East Fork of Scott River. R. Crawford, of Callahans, owner.

*Sheffield Mine* (Hydraulic).—This mine is on the North Fork of Salmon River, about 2 miles below Sawyer's Bar. E. Sheffield of Sawyer's Bar, owner.

*Sheffield Mine* (Quartz).—This mine is situated upon the ridge between Eddy's Gulch and White's Gulch, about 4 miles E. of Sawyer's Bar. The developments consist of several thousand feet of tunneling. There are two veins, one a blanket ledge about 8 ft. in width, and another vein, which is 2 ft. wide. There is an 8-stamp mill at this mine, which is run by water power. Sheffield Estate, owners; E. Sheffield, of Sawyer's Bar, agent.

*Shell Mine* (Placer).—This is in Quartz Valley District. W. Shell, of Fort Jones, owner.

*Shiner Mine* (Hydraulic).—This claim is about 8 miles below Seiad, on the north side of Klamath River. Shiner Bros., of Seiad, owners.

*Short Mine* (Quartz).—It is on Trail Creek, a tributary to East Fork of Salmon River. It is said that developments consist of a 100 ft. shaft and a 140 ft. tunnel; vein shows an average width of about 18 inches. W. Walters & Co., of Callahans, owners.

*Short Mine* (Placer).—This mine is on Trail Creek, a tributary of the East Fork of Salmon River. W. F. Short, of Callahans, owner.

*Shumway Mine* (Placer).—This is on the North Fork of Salmon River, near Forks of Salmon. Shumway Bros., of Forks of Salmon, owners.

*Side Hill Mine* (Hydraulic).—This mine is on the South Fork of Scott River. Chinese Company, owners.

*Sightman Mine* (Hydraulic).—This claim is on the South Fork of Salmon River, about 20 miles above the Salmon. George Sightman, of Cecilville, owner.

*Skunk Hill Mine* (Hydraulic).—This is about  $1\frac{1}{2}$  miles from Scott's Bar. Reynolds & Jacobs, of Scott River, owners.

*Smith's Claim* (Drift).—This is in the immediate vicinity of Callahans, and comprises 300 ft. of the river front, running 200 ft. back. The gravel is about 25 ft. thick and prospects well. H. Smith, of Callahans, owner.

*Smith Mine* (Quartz).—It is on French Creek, a tributary of Scott River. It is stated that the developments consist of a 50 ft. shaft and other workings, and that the vein shows an average width of about 2 ft. At this mine there is a 5-stamp mill, run by water power. J. Smith, of Callahans, owner.

*Smith Mine* (Quartz).—This mine is on the south side of Klamath River, about 4 miles above American Bar. The developments consist of several hundred feet of tunnels and stopes. There is a 5-stamp mill at this mine, run by water power. J. E. Smith et al., of Henley, owners.

*Smith Mine* (Drift).—This claim is about  $6\frac{1}{2}$  miles above Happy Camp, on the north side of Klamath. M. Smith, of Happy Camp, owner.

*Smith & Harvey Mine* (Placer).—This mine is in Cottonwood District. W. Smith and A. Harvey, of Yreka, owners.

*Smith & Marion Mine* (Quartz).—This is in White's Gulch, and about 4 miles from Sawyer's Bar. It is stated that the developments consist of a 300 ft. tunnel; the vein is about 3 ft. wide. Smith & Marion, of Sawyer's Bar, owners.

*Sniktaw Mines* (Placer).—These mines are situated in Quartz Valley District. Fort Jones Mining Company, of Fort Jones, owners; N. H. Smith, President.

*Spangler Mine* (Placer).—This mine is on Klamath River, at the mouth of Humbug Creek. C. Spangler, of Yreka, agent.

*Spencer Mine* (Quartz).—See our XIth Report, p. 445.

*Squaw Gulch Mine* (Hydraulic).—This claim is on Squaw Gulch Creek, a tributary of Scott River. Jean Bolongéot, of Callahans, owner.

*Steamboat Mine* (Drift).—This mine is on McAdams Creek. Geo. Smith and Jo Stevens, of Etna, owners.

*Stearns Mine* (Hydraulic).—This mine is on Jackson Creek, a tributary of the South Fork of Scott River. W. H. Stearns, of Callahans, owner.

*Steel Mine* (Quartz).—This mine is in the Quartz Valley District. There is a 150 ft. tunnel on an 8 to 18 in. vein. Sargent Bros., of Oro Fino, owners.



*Sterling Mine* (Quartz).—See our XIth Report, p. 446.

*Stewart Mine* (Hydraulic).—This claim is on Indian Creek. J. Stewart and J. Moore, of Fort Jones, owners.

*Stillwell Mine* (Placer).—This is 4 miles above the mouth of Horse Creek. — Johnson, of Oak Bar, owner.

*Stockton Mine* (Drift).—This mine is in Quartz Valley Mining District. The developments consist of a tunnel several thousand feet in length and numerous drifts. Stockton Gravel Mining Company, owners; H. Radbruch, of Fort Jones, agent.

*Store Mine* (Quartz).—This mine is in Quartz Valley District. There is a 100 ft. incline and a 300 ft. tunnel; the vein varies from 6 to 3 ft. in width. H. J. Diggles, of Fort Jones, owner.

*Sugar Hill Mine* (Drift).—This is on Fox Creek, a tributary of the South Fork of Scott River. The developments consist of several hundred feet of tunneling. Geo. W. Smith, of Callahans, owner.

*Summerville Mine* (Hydraulic).—This claim is on the South Fork of Salmon River, 26 miles above Forks of Salmon. Fred Smith & Co., of Cecilville, owners.

*Taylor & Maplesden Mine* (Drift).—This is at Hamburg Bar, on the south side of the Klamath. A. Taylor and B. F. Maplesden, of Hamburg Bar, owners.

*Tea Bar Mine* (Hydraulic).—This mine is about 5 miles below Cottage Grove, on the south side of Klamath River.

*Thomas & Dupré Mine* (Quartz).—This mine is in Hungry Creek. The developments consist of a 30 ft. shaft and a tunnel more than 100 ft. in length. Thomas & Dupré, of Henley, owners.

*Thompson Mine* (Hydraulic).—This mine is on Hungry Creek. — Thompson, of Coles, owner.

*Tiger Mine* (Hydraulic).—See our XIth Report, p. 437.

*Uncle Sam Mine* (Quartz).—This is 7 miles E. from Sawyer's Bar, and comprises 4,500 by 600 ft. The 5 ft. vein courses N. of E. and dips 50° N., between slate and porphyry walls. There is an 8-stamp mill on the ground. E. Sheffield et al., of Sawyer's Bar, owners.

*U. S. (Buckhorn Boys') Claim* (Placer).—This is 2½ miles below Sawyer's Bar, and is a river claim 1,200 ft. long by 200 ft. wide. The four owners are turning the river at this point. G. A. Moore et al., of Sawyer's Bar, owners.

*Van Vector, Perrier & Evans Mine* (Placer).—This mine is on Beaver Creek. Van Vector, Perrier & Evans, of Coles, owners.

*Volcano Mine* (Quartz).—This claim is in Quartz Valley Mining District. The developments consist of an 80 ft. tunnel. The vein shows an average width of about 1 ft. Sargent Bros., of Oro Fino, owners.

*Walker Bar Mine* (Hydraulic).—This claim is about 14 miles below Happy Camp, on the north side of the Klamath. Chinese Company, owners.

*Walker Bar Mine* (Placer).—This is about 7 miles below Hamburg Bar, on the south side of Klamath River. Chinese Company, owners.

*Weston Mine* (Placer).—This property is about 18 miles from the mouth of Thompson Creek. — Weston, of Seiad, owner.

*White Mine* (Placer).—This is on Humbug Creek. Sam White, of Walker, owner.

*White & Rider Mines* (Hydraulic).—These are on Little Humbug Creek, about  $2\frac{1}{2}$  miles from its mouth. S. White and E. Rider, of Walker, owners.

*Wilken Mine* (Hydraulic).—This mine is on the East Fork of Scott River. G. Wilken, of Callahans, owner.

*Willard & Hickman Mine* (Hydraulic).—This claim is one fourth of a mile below Hamburg Bar, on the south side of Klamath River. C. Willard and J. Hickman, owners.

*Willey Mine* (Hydraulic).—This mine is on Beaver Creek. J. D. Willey, of Coles, owner.

*Willheim Mine* (Placer).—It is on Wildcat Creek, a tributary of Scott River. — Willheim, of Callahans, owner.

*Williams Mine* (Hydraulic).—This claim is on the west side of Salmon River, about 6 miles below Forks of Salmon. L. Williams et al., of Forks of Salmon, owners.

*Willie Mine* (Placer).—This mine is on McAdams Creek. Willie Company, of Etna, owners.

*Windeler Mine* (Hydraulic).—This claim is on the South Fork of Salmon River, and about  $1\frac{1}{2}$  miles above Sawyer's Bar. J. C. Windeler, of Sawyer's Bar, owner.

*Wingate Mine* (Hydraulic).—This mine is about 9 miles below Happy Valley, on the north side of Klamath River. H. Gasquet, of Gasquet, Del Norte County, owner.

*Wood Mine* (Hydraulic).—This claim is at the mouth of Thompson Creek, about 7 miles below Seiad, and on the north bank of Klamath River. J. Wood, of Seiad, owner.

*Wood, Geo., Mine* (Hydraulic).—This claim is about 5 miles above Happy Camp, on the south side of Klamath River. J. Camp, of Fort Jones, owner.

*Wright & Fletcher Mine* (Hydraulic).—This is in Oro Fino District. Wright & Fletcher, of Oro Fino, owners.

#### STANISLAUS COUNTY.

The agricultural interests are paramount, and to this end the works of the Turlock and Modesto Irrigation Districts are being hastened toward completion. In the eastern foothills, however, some gold mining is carried on. On the western side of the county borings have been made to prospect petroleum-yielding formations, and in the Mount Diablo range there are deposits of quicksilver, manganese, and coal, which will in time prove valuable.

*Ferguson Mines* (Drift).—These mines are principally situated on land of the La Grange Hydraulic Ditch and Mining Company, and give employment to 6 men.

*La Grange Mining Company's Mines* (Hydraulic and Drift).—They are situated on the Tuolumne River, at La Grange. During the winter of 1893-94 about 50 men were employed at these mines, and it is said that the privilege of working the company's ground could be secured in consideration of the miners selling their gold to the company, and buying their supplies at the company's store. See our Xth Report, p. 681.

## TEHAMA COUNTY.

Tehama County is situated at the northern end of the Sacramento Valley, and comprises valley, foothill, and mountain lands, nearly in equal proportions.

Owing to its geographical position, this county usually enjoys a larger rainfall than any other county in the Central Valley of California. The valleys and foothills are devoted to agriculture, fruit-growing, and stock-raising. In the mountainous portions of the county the mineral deposits which have hitherto been developed are not numerous, but there is an immense body of chromic iron, for which there appears to be an increasing demand. There are also other minerals which have not as yet been turned to practical account.

In this county there are numerous mineral springs, whose remedial virtues are greatly extolled, the most noted being Tuscan Springs, in the foothills of the Sierra.

In 1889, a ledge of gold-bearing rock was discovered by H. Ragland, on the North Fork of Elder Creek, and about  $1\frac{1}{2}$  miles N.W. of the property of the Tehama Consolidated Chrome Deposit Company. Shallow workings developed only low-grade ore, although high assays were said to have been obtained from samples.

## TULARE COUNTY.

Although chiefly interested in agriculture, the county has gold-mining interests that have not been fully developed, as well as quarries of undoubted excellence and economic value. There has been a revival in the mining interest in that section of country of which the White River Mining District forms a part, while the foothills furnish building-stone at a point offering many natural advantages. As this county requires irrigation, which depends largely on subterranean sources, and these currents have been subjects of former investigation by the Bureau, we would refer to our XIth Report.

*Adams Flat Mines* (Placer).—These mines are about 5 miles S. of Auckland P. O., and are usually worked about three months in early spring. A. B. Brown and B. Willis, of Auckland, owners.

*Ante-up Mine* (Quartz).—It is in Pius Cañon, White River Mining District. In a 12 ft. shaft the vein shows a width of 6 in.; the walls are granitic. Chas. Newby, of White River, owner.

*Bald Mountain Mine* (Quartz).—This is on Bald Mountain, in White River Mining District. The developments consist of two tunnels, 1,600 and 490 ft. long, and two shafts nearly 200 ft. deep. The vein is 4 to 6 ft. wide, with a 2 ft. pay streak; the walls are granitic. It is furnished with a steam hoist. The ore was formerly worked in a 10-stamp custom mill. J. D. Flaughner, of White River, owner.

*Barton Mine* (Quartz).—It is in Sec. 21, T. 15 S., R. 25 E., and on Rattlesnake Creek. The developments are a 350 and a 220 ft. tunnel. There is a 50 ft. upraise from the latter. The 3 ft. ledge dips  $75^{\circ}$  E., in a granitic rock impregnated with quartz and carrying free gold. The country rock is principally syenite, in places schistose, and passes apparently into mica slate. The ore is worked in a  $3\frac{1}{2}$  ft. Huntington mill. The tailings contain a black sand, which is said to have shown



a high value by assay. See our XIth Report, p. 491. H. D. Barton, of Auckland, owner.

*Black Prince Mine* (Quartz).—It is situated in Redwood Cañon, about 10 miles S.E. of Camp Badger, in the Finger Rock Mining District. The developments are a 50 ft. shaft and a 100 ft. tunnel. The vein is nearly 5 ft. wide. E. Walters, of Camp Badger, owner.

*Blue Bird Mine* (Quartz).—This mine is in Finger Rock Mining District, about 12 miles from Camp Badger. The developments consist of tunnels 65 to 120 ft. in length. Kirkland Bros., of Auckland, owners.

*Blue Mountain Mine* (Quartz).—The claim is on the western slope of Blue Mountain, in White River Mining District. The vein, 14 in. wide, is nearly vertical, and courses N.E. and carries free gold with sulphurets. J. C. McDonald, of White River, owner.

*Clara Gibbons Mine* (Quartz).—This is in Chileno Gulch, in White River Mining District. Developed by a 24 ft. shaft and open cuts. The vein varies in thickness from a few inches to about 2 ft., and dips about 45° S.E. The quartz shows galena and iron pyrites. The walls are granitic. C. H. Gibbons and A. Bowen, of White River, owners.

*Domingo Mine* (Quartz).—This claim is in the Finger Rock Mining District. E. Walters, of Camp Badger, owner.

*Eastern Extension of the Isian Peak Mine* (Quartz).—This is situated in the White River Mining District. M. G. Ford, of White River, owner.

*Eclipse Mine No. 2* (Quartz).—It is in White River Mining District. The developments consist of a 250 ft. tunnel and a 130 ft. winze, also extensive stopes. The vein, 8 to 18 in. wide, dips about 60° W. of N. The hanging-wall is granite and the foot-wall a granitic schist, passing into mica slate. White River Mining Company, of London, England, owners; B. Allen & Co., of White River, lessees.

*Ely Mine* (Quartz).—This claim is in Sec. 27, T. 24 S., R. 29 E., White River Mining District. There is a 110 ft. shaft, on a 4 to 10 in. vein. Ross Keller, of White River, owner.

*Eschscholtzia Mine* (Quartz).—It is on Lime Creek. There are two short tunnels on a 10 in. vein.

*Golden Treasure Mine* (Quartz).—This is in Chileno Gulch, in White River Mining District. Developed by two open cuts. The vein is about 1 ft. wide and dips 20° S.E. The walls are granitic. J. Jacombs, of White River, owner.

*Good Enough Mine* (Quartz).—This claim is on the north bank of White River, in White River Mining District. The developments consist of a 110 ft. shaft, with stopes. R. Keller, of White River, owner.

*Gray Eagle Mine* (Quartz).—This claim is in the Finger Rock Mining District. There is an 80 ft. tunnel and a 60 ft. shaft.

*Hard Tack Mine* (Quartz).—It is in White River Mining District. The shaft is 30 ft. deep on a 6 in. vein. Norman Brown, of White River, owner.

*Hard Times Mine* (Quartz).—This is in Chileno Gulch, White River Mining District. Developed by a 70 ft. tunnel and an open cut. The vein is 3 to 6 in. wide, and dips 30° S. J. Jacombs et al., of White River, owners.

*Harvest Home Mine* (Quartz).—It is in White River Mining District. There are two shafts, 40 and 60 ft. deep, and a tunnel 40 ft. long. The vein is 6 to 18 in. wide. C. Wilbern, of White River, owner.

*Hidden Treasure Mine* (Quartz).—It is in White River Mining District. The vein is 1 to 6 in. wide, and dips 30° S.E. T. F. Owens et al., of White River, owners.

*Homestake Mine* (Quartz).—This claim is in White River Mining District. The developments consist of a 300 ft. and a 125 ft. tunnel, connected by a 46 ft. upraise. The vein is 3 to 12 in. wide, and dips 80°. At this mine there is a 5-stamp mill. D. W. Grover and W. H. Duke, of White River, owners.

*Isian Peak Mine* (Quartz).—This claim is near Grizzly Gulch, in White River Mining District. There is a 25 ft. shaft; the vein is 6 to 12 in. wide. G. Dover, of White River, owner.

*Keys Mine* (Quartz).—This claim is on the South Fork of Tule River, in White River Mining District. Developments consist of three shafts, 100, 60, and 25 ft. deep, with sundry levels and stopes. H. A. Harris, of White River, owner.

*Last Chance (Redfield) Mine* (Quartz).—This is on Bald Mountain, in White River Mining District. The developments consist of a 300 ft. tunnel and a 100 ft. shaft, with stopes. The vein is about 4 ft. in width, with granitic walls. J. D. Flaughner, of White River, Superintendent.

*Lucky Cuss Mine* (Quartz).—This claim is in White River Mining District. Developed by a 100 ft. tunnel; the vein varies from a few inches to 3 ft. in width. B. Allen, of White River, owner.

*Mammoth Mine* (Quartz).—This claim is on the Middle Fork of Tule River, about 40 miles E. of Lindsay, on the S. P. R. R. There is a 30 ft. tunnel; the vein is said to be 4 ft. in width. J. Goldstein, of Lindsay, owner.

*Mineral King Mines*.—These mines are situated in the high Sierra, at a distance of about 60 miles by road in a northeasterly direction from Visalia. See our VIIIth Report, p. 646.

*Old Soldier Mine* (Quartz).—This mine is situated in Drum Valley, and is said to yield garnets, topazolite, epidote, and tourmaline.

*Otter Mine* (Quartz).—This mine is in Coarse Gold Gulch, in White River Mining District. There is a 100 ft. and a 60 ft. shaft, which are now partly filled with water. J. W. Beaver et al., of White River, owners.

*Page Mine* (Quartz).—This claim is 7 miles N.E. of Visalia, in Sec. 17, T. 18 S., R. 26 E. There are two small prospect shafts on a vein several feet in width, which appears to be formed by silicious infiltrations impregnating the country rock. The vein can be traced for several miles and dips 80° S.E. J. E. Prothers, of Visalia, owner.

*Pincher and Bulger Mine* (Quartz).—It is on Lime Creek, a tributary of the Kaweah River. The developments consist of a 70 ft. incline and a 150 ft. tunnel. The vein averages 3 ft. wide. J. Edwards and D. R. Stevens, of Visalia, owners.

*Redfield Mine*.—See Last Chance Mine.

*Richelieu Mine* (Quartz).—In White River Mining District. Developed by a 90 ft. shaft and a 100 ft. tunnel. The vein is about 2 ft. wide and dips 80° N. in granite. J. D. Flaughner, of White River, owner.

*Sarah Tucker Mine* (Quartz).—It is in White River Mining District. A short tunnel shows a vein 8 in. to 2 ft. wide. C. Briggs, of White River, owner.

*Simmons Mine* (Quartz).—This is an eastern extension of Bald Mountain Mine. The ledge now shows a width of about 3 ft. in the

bottom of a 50 ft. shaft. J. E. Dunlap and W. Davis, of White River, owners.

*Stancil Mine* (Quartz).—It is on Bald Mountain, in White River Mining District. Opened by a 500 ft. tunnel, with stopes. The main vein is 6 to 18 in. wide, and dips 80° N. The quartz carries some sulphurets. There are two other veins in this mine, the course of which does not coincide with that of the main lode. J. D. Flaughter, of White River, Superintendent.

*Sunset Mine* (Quartz).—In White River Mining District. The vein is 7 to 18 in. wide, in micaceous slate walls. T. J. Mayfield, of White River, owner.

*Vulture Mine* (Quartz).—This claim is in White River Mining District, and is an eastern extension of the Grizzly. The developments consist of a 340 ft. and an 80 ft. shaft; also various drifts and stopes. The width of the vein varies from 6 in. to 4 ft. The ore shows sulphurets and free gold. A. R. Sorrells, of White River, owner.

*Way-up Claim* (Placer).—It is on Ten-Mile Creek, in Finger Rock Mining District, about 20 miles N.E. from Camp Badger. E. S. Balam, of Camp Badger, owner.

*W. Hart Mine* (Quartz).—In Finger Rock Mining District, and is a southern extension of the Gray Eagle. W. Hart, of Camp Badger, owner.

*White River Mining District.*—The country rock is principally syenite, with one or more streaks of crystalline limestone. These streaks have a northeasterly and southwesterly trend. Accompanying the limestone are copper-bearing rocks. The auriferous veins traversing the syenite are fissure veins, and the prevailing dip is southwesterly. In the western portion of the district a micaceous slate forms what is locally known as the "slate range," and some mines are situated thereon.

#### TUOLUMNE COUNTY.

In Tuolumne County a decided impetus has been given to the mining industry, both by new discoveries in mines already in operation, and by reopening properties which have long been idle. Heretofore more attention was given to "pocket mining" than to mines which yield a comparatively low grade of quartz, and require mills; but the list of properties supplied with mills is largely augmented, and accessions are constantly being made. Numerous transfers of mining properties are being recorded, and Tuolumne advances with its neighbors.

*Ah Mow Mine.*—It is 1 mile N.W. of Columbia, on the "white gravel leads." In the summer of 1893, 12 Chinese were working a large pit having a superficial area of nearly 10,000 ft. and a depth of 80 ft. The gravel was hoisted in large frame boxes by a huge derrick at the top of the pit. Most of the material of this lead is white quartz. The once nearly or quite horizontal bed has been lifted and faulted until now it has a steep pitch like a vein. The edges of the faulted deposit are turned upward at the center, the gravel dipping both ways from the fault plane. The deposit is overlaid with white volcanic ash (tufa), the stratification of which shows the folding and faulting of the beds more plainly than the layer of gravel.

*Alabama Mine* (Quartz).—It is 1½ miles W. of Jamestown, on the "Mother Lode." See our Xth Report, pp. 53 and 741. A brush fire communicated with the hoisting works in 1893 and destroyed them.



*Alameda Mine* (Quartz).—One mile N.W. of Jamestown, on the "Mother Lode." M. B. Harriman, of Sonora, owner.

*Alta Mine* (Quartz).—See our Xth Report, p. 757.

*App & Heslep Mine* (Quartz).—It is on Quartz Mountain, 1 mile S.E. of Jamestown. See our VIIIth Report, p. 660. In 1893 the water was taken out of the shaft with a view of resuming operations. Martin, Ballard & Neville, of Jamestown, owners.

*Argentum Mine* (Quartz).—It is located in the American Camp District, 10 miles N.E. of Sonora. The developments show two veins, separated by 4 ft. of dike rock; both outside walls are black slate. The quartz contains iron and lead sulphurets and occasionally zinc-blende. J. B. Pownall, of Columbia, owner.

*Belcher Consolidated Mine* (Quartz).—It is  $1\frac{1}{2}$  miles N.W. from Groveland. See our VIIIth Report, p. 672. Belcher Consolidated Mining Company (Limited), of London, England, lessees.

*Belle View (Hyde) Mine* (Quartz).—See our Xth and XIth Reports, pp. 755 and 501. It is 6 miles N.E. of Sonora, and for a number of years lay dormant, but in 1889 work was resumed and has been successfully prosecuted ever since. Belle View Mining and Agricultural Company, owners.

*Big Oak Flat Region* consists of a granitic area almost if not completely surrounded by slates and schists and other metamorphic rocks. In this region are several large quartz veins, on which are the Cosmopolite and Mississippi mines. The vein system is somewhat intricate, as they strike in various directions, and frequently intersect. Nearly all the veins cross the granite, reaching into the slates. Gold is found in all the veins, but usually in small amounts, and the "tellurides" are found in the Conrad vein, on the east side of Big Oak Flat. The Mississippi vein lies near the west border of the granite. It is a large, well-defined vein, but low grade.

*Black Oak Mine* (Quartz).—It is three fourths of a mile S.W. of Soulsbyville. The property also includes the Live Oak Mine. See our VIIIth, Xth, and XIth Reports, pp. 665, 744, and 500. Since then the shaft has reached a depth of 600 ft. and new levels were run. The quartz carries considerable iron, zinc, lead, and copper sulphurets, and magnetic iron pyrites (pyrrhotite). Scott, Dowe & Co., of Soulsbyville, owners.

*Bonanza Mine* (Quartz).—This property, at Sonora, has won the reputation of being the most prolific producer of "pocket gold" in the world. Descriptions and other information concerning it may be found in our VIIIth, IXth, Xth, and XIth Reports, pp. 652, 736, and 511. Since our last publication the workings have reached a depth of 1,300 ft. on the incline. The pockets have ranged from \$4,000 to \$300,000, usually being between \$20,000 and \$50,000. The Bonanza vein, as it may be called, is a dike of light greenish-gray rock of felsitic texture, containing frequently chloritic scales. In width it varies from 8 to 16 ft. It strikes N.  $30^{\circ}$  E., dips  $20^{\circ}$  to  $25^{\circ}$  E., and is the youngest dike in the region, cutting all older dikes. The slates, which are intruded by the dike, strike N.  $30^{\circ}$  W., and dip  $65^{\circ}$  to  $70^{\circ}$  N.E. Though the Bonanza dike traverses older dikes and several varieties of metamorphic rocks and limestone, the gold is only found associated with a pyritous slaty zone, 4 to 12 ft. in width. On the west side of this is an argillite with slaty cleavage, but having comparatively massive structure. On the

east side is a dense quartzose rock, locally called trap, though in fact a metamorphic sedimentary rock. Within the belt of pyritous black slate occur four seams not over 3 in. in width at any place, and usually but a small fraction of an inch. One of these fissures separates the pyritous slate from the more massive slate on the west side. The others are within the black slate itself. The strike of these seams varies but little, being practically parallel and conforming to the strike of the slates. Occasionally in the west crevice, quartz may be found in the form of a little vein, and again a thin sheet of decomposed rock of undoubted eruptive origin. These small fissures are called "crossings."

A second series of seams strike into the dike from the hanging-wall side, cutting slates and other rocks in both strike and dip. These seams all pitch southwestward, and are known as "gold seams."

The dike includes, in the upper portion of the mine, three veins of quartz, one of which lies on the hanging-wall or upper side, one on the bottom, and the third about the middle. The sheets of quartz conform to the strike and dip of the dike. In thickness they vary from an inch or two to 2 ft. In the lower workings the quartz appears to have been concentrated in the central portion of the dike, separated from the slates above and below by 4 to 10 ft. of dike rock. No gold is found in this lower portion of the mine. The slates are, moreover, greatly disturbed by the intrusion of large dikes of diorite, which here almost exclude the slates.

The Bonanza dike is a plane of movement as well as of displacement, the hanging-wall having moved upward and to the west relatively to the foot-wall. This diagonal movement is almost exactly 16 ft. in either direction. The "crossings" and "gold seams" are found in the slates of the foot-wall as well as on the hanging-wall, showing them to be older than the dikes.

As previously stated, all the gold found in this mine was discovered within the narrow belt of black pyritous slate either on the hanging-wall or foot-wall side at contact with the quartz, or in the central quartz vein midway between the walls. Gold is only found, even in the places mentioned, where a "crossing" and a "gold seam" intersect on the plane of the quartz veins. The "crossings" and "gold seams" each continue through the dike, though in a somewhat erratic manner. Another and most remarkable thing is that the pockets of gold were found at alternate crossings or seams. It was found, during the years of operation of this mine, that these pockets of gold were distributed with almost mechanical regularity. Bonanza Mining Company, of Sonora, owners.

*Buchanan Mine* (Quartz).—It is on the summit of a high ridge on the northern side of the Middle Fork of Tuolumne River, about 10 miles E. of Sonora. It is on the "east lode." See our VIIIth, Xth, and XIth Reports, pp. 666, 752, and 494. In 1893 a drift to connect with old workings was being driven. Davis & Barron, of San Francisco, owners.

*Canondale Mine* (Placer).—It is in Columbia. Diego Lorenzo & Co., of Columbia, owners.

*Carlotta Mine* (Quartz).—This is half a mile N.W. of Summersville. See our XIth Report, p. 499.

*Chaparral Mine* (Quartz).—It adjoins the Buchanan Mine, 10 miles east of Sonora. See our XIth Report, p. 496.

*Colin & Basovitch Mine* (Placer).—This is 2 miles E. of Columbia. In this vicinity are several shallow placer claims, which are worked by the ground-sluice method, and some deep pits, from which the gravel is hoisted by water-power derricks, dumped in large puddling bins, where it is disintegrated by powerful streams from "giants," and the gravel then passed into sluices. Colin & Basovitch, of Columbia, owners.

*Colin & Graham Mine* (Quartz).—It is  $2\frac{1}{2}$  miles S.E. of Columbia, near Sawmill Flat. The mine is being reopened. It is equipped with a hoist and a 4-stamp mill. The vein is from 1 in. to 3 ft. in width. The walls are mica schist, with frequently an intrusive mass of felsitic rock, much decomposed. The shoots of quartz are extremely irregular, but the rock is of good grade. Colin, Graham & Co., of Columbia, owners.

*Columbus Mine* (Quartz).—This is in Cherokee, 7 miles N.E. of Sonora. It occurs on a "swell" in the vein, caused by the deposition of a large lens of quartz on the hanging-wall side of the main fissure. It has walls of hornblende granite. After an idleness of twenty-five years, the mine is now being reopened. This mine and those near it all belong to the "east lode" series. The foot-wall vein is massive, and is separated by 12 ft. of broken rock and quartz from the hanging-wall vein. Capt. Johns, of San Francisco, lessee.

*Confidence Mine* (Quartz).—It is  $4\frac{1}{2}$  miles N.N.E. of Soulsbyville. See our XIth Report, p. 503. R. Chute, of San Francisco, owner.

*Conrad Mine* (Quartz).—See Big Oak Flat region. A. Conrad, owner.

*Consolidated Eureka Mines* (Quartz).—This property, in Summersville, comprises the Eureka and Dead Horse claims. The latter is in operation. These mines, which are in the "east lode," are described in our VIIIth, Xth, and XIth Reports, pp. 664, 750, and 498. A notable fact concerning this mine is that the best quartz is found in contact with a granite dike, which at places accompanies the vein. The country rock is mica schist and mica slate. The granite dike seldom continues in contact with the vein for more than 60 ft. The walls are plainly striated, the grooves pitching S.E., which is also the direction of the pitch of the pay shoot. A dike of diabase occurs near the Eureka Mine, a short distance N.W. of the Dead Horse. It is said that a rich pay shoot was found in close proximity to this dike. Alvinza Hayward, of San Francisco, owner.

*Consuella Mine* (Quartz).—This is on the south side of the North Fork of Tuolumne River, a mile S.E. of Summersville, and is on the "east lode." Formerly well equipped, it has now been idle for years. The vein is from 1 to 16 ft. in width; average, 5 ft. There are two pay shoots, one of which is 80 ft. long; the other is known to be 40 ft. in length, and it may be longer. D. B. Warfield, of Oakdale, owner.

*Cosmopolite Mine* (Quartz).—It is half a mile S.E. of Big Oak Flat. The vein strikes N.  $10^{\circ}$  E. and dips  $45^{\circ}$  W; it has been extensively worked in its upper portion. The mine is working now under a lease. The east and west ends of the vein are in slates, and the middle portion in the granite of Big Oak Flat basin. A granitic dike accompanies the vein in that portion having slate walls. Poole, Reid & Co., of Groveland, lessees.

*Darrow Mine* (Quartz).—It is 5 miles W. of Sonora. It is a "pocket" vein, occurring in diabase. A small number of men are employed. Darrow & Co., of Sonora, owners.



*Dead Horse Mine* (Quartz).—See Consolidated Eureka.

*Dutch Mine* (Quartz).—See our Xth Report, p. 51. Working in 1893.

*Eureka Mine* (Quartz).—It is near Sonora, on the Jamestown road. The vein is 4 ft. wide, in slate, which changes to chloritic schist about 20 ft. below the surface. Fitzgerald & Co., of Jamestown, owners.

*Eureka Mine* (Quartz).—See Consolidated Eureka.

*Florence Mine* (Quartz).—This is 5 miles W. of Sonora, and about 4,000 ft. E. of the "Mother Lode." It is a recent discovery, and consists of quartz seams in a mineralized dike of felsitic rock, the upper portion being much decomposed and containing free gold. The hanging-wall rock of the dike is diabase, through which a 120 ft. tunnel was driven toward the vein. The foot-wall side has a slaty structure, but is probably altered diabase, too much decomposed to determine. Bromley & Orlando, of Sonora, owners.

*Ford Mine* (Quartz).—See Page.

*Garfield and Virginia Mines* (Quartz).—These are 12 miles E. of Sonora, near the Buchanan Mine, on the north side of the Main Fork of Tuolumne River. The group is on the "east lode," and are well situated for economical mining and milling. Garfield-Virginia Mining Company, of Sonora, owners.

*Garrett Mine* (Quartz).—See Page Mine.

*Gem Mine* (Quartz).—It is on the "Mother Lode,"  $1\frac{1}{2}$  miles N.W. of Jamestown. See our VIIIth and Xth Reports, pp. 663 and 742.

*Gem Mine* (Quartz).—It is 3 miles N.W. of Columbia. It has a 10-stamp mill and hoisting works, run by water under a high head.

*Golden Gate Mine* (Quartz).—It is 1 mile S.E. of Sonora. See our Xth and XIth Reports, pp. 738 and 511. Since the last report the developments have been carried nearly 200 ft. deeper. A very complete canvas plant for saving the slimes escaping the vanning machines has been erected, and resulted in a very large saving of material, which would otherwise have been lost. The vein varies from a small seam to 20 ft. in width, occurring entirely in diorite. The quartz and auriferous sulphurets have been deposited in a zone of crushed rock along the sides of a plane of faulting. In some places the vein or fissure exhibits a branching tendency, but the main crevice is usually well defined. The diorite has a slaty, schistose, or splintery structure on either side of the fissure. The mine is strongly timbered. No "colors" can be obtained by panning, as the gold is contained almost exclusively in the sulphurets. Golden Gate Mining Company, of Sonora, owners.

*Grizzly Mine* (Quartz).—It is about  $1\frac{1}{2}$  miles S.E. of Summersville, on the "east lode." John Leachman, of San Francisco, owner.

*Grizzly Mine* (Quartz).—This is 1 mile N. of Priest's Hotel, on the Yosemite road, and  $1\frac{1}{2}$  miles N.W. from Big Oak Flat. It is a "pocket mine," and in operation. James & Harper, of Big Oak Flat, owners.

*Henrietta Mine* (Quartz).—It is 4 miles N.E. of Summersville, on the North Fork of the Tuolumne River. The vein is 4 to 5 ft. wide. The developments consist of a 50 ft. shaft and a 130 ft. cross-cut tunnel. The quartz contains a heavy percentage of iron and lead sulphurets. C. F. Haslam, owner.

*Heslep Mine* (Quartz).—See App Mine.

*Holmes Mine* (Quartz).—See Miller Mine.

*Hunter (Todd & Hunter) Mine* (Quartz).—It is 10 miles E. of Sonora and half a mile N.W. of the Buchanan, on the "east lode." It is

equipped with hoisting and milling machinery. J. P. Sullivan, of San Francisco, owner.

*Hyde Mine* (Quartz).—See Belle View Mine.

*Isabella Mine* (Quartz).—It is  $1\frac{1}{2}$  miles N.W. of Jamestown, on the "Mother Lode."

*Kanaka Mine* (Quartz).—It is 6 miles E. of Groveland, on the "east lode." See our VIIIth Report, p. 669. In 1893 a new level was being opened in the lowest workings. Most of the quartz milled at that time was being stoped from the upper levels. A deep cross-cut tunnel to drain and still further develop the property was under consideration. Louis Cassaretto, of Groveland, owner.

*Keltz Mine* (Quartz).—It is 10 miles N. of Soulsbyville, near Elizabeth Peak, on the South Fork of the Stanislaus. This mine is on the "east lode," and is one of the most important on that belt. See our Xth and XIth Reports, pp. 755 and 504. The description of the Hite Mine covers the geological characteristics of this mine. Since the issuance of the last report 10 stamps have been added to the mill, making 20 stamps in all, with a capacity of 35 tons daily. The vein is from 1 to 10 ft. wide. Leechman Prospecting Company, of San Francisco, owners.

*Knox & Boyle Mine* (Quartz).—See our Xth Report, p. 51. Working in 1893.

*Kriss-Cross Mine* (Quartz).—It is 1 mile N. of Priest's Hotel, on the Yosemite stage road, and 2 miles N.W. of Big Oak Flat. A shaft 50 ft. deep has exposed two veins, one of 22 in. and one of 14 in. in width, separated by a foot of barren slaty material. It is a new prospect, located in 1893. Hughes & Brown, of Chinese Camp, owners.

*Lady Washington Mine* (Quartz).—This is half a mile S. of Summersville, and is on the southeast extension of the Consolidated Eureka Mines. See our Xth and XIth Reports, pp. 752 and 498. A large amount of development shows this to be a promising mine. It was said that operations were to be resumed in the fall of 1893. Geologically it is quite similar to the Dead Horse, which it joins. F. H. Hill, of Summersville, lessee.

*Laura and North Star Mines* (Quartz).—They are on the "east lode," between Cherokee and Summersville. See our XIth Report, p. 498. After an idleness of several years operations were resumed on these mines in the summer of 1893.

*Live Oak Mine* (Quartz).—See Black Oak Mine.

*Longfellow Mine* (Quartz).—This is near Big Oak Flat. See our VIIIth and XIth Reports, pp. 672 and 494. D. Longfellow, of Groveland, owner.

*Lumsden Mine* (Quartz).—It is half a mile S.E. of Priest's Hotel, on the Yosemite road. The veins occur in a soft, black, pyritous slate. A long drain tunnel reaches a vertical depth of 50 ft. A large amount of gold has been sluiced from the surface and found in pockets in the several veins, accompanied by dike rocks. See our XIth Report, p. 494. The owners work only during the winter season. D. Lumsden & Son, of Big Grove Flat, owners.

*Martha Washington Mine* (Hydraulic and Drift).—It is on Table Mountain, 5 miles W. of Chinese Camp. The corporation owning this property is composed of California ladies. Operations were suspended in 1893. Martha Washington Gravel Mining Company, of Oakland, owners.

*Meade Mine* (Placer).—In Columbia. Working. G. L. Meade, of Columbia, owner.

*Miller & Holmes Mine* (Quartz).—It is on Quartz Mountain,  $1\frac{1}{2}$  miles S.E. of Jamestown. There are two veins in this property, 170 ft. apart. As development had just begun in 1893, little can be said of this property, excepting that its characteristics are those common to this portion of the "Mother Lode." Miller & Holmes Mining Company, of Jamestown, owners.

*Mississippi Mine* (Quartz).—See Big Oak Flat region. John McLaughlin, of Coulterville, Mariposa County, owner.

*Monitor Mine* (Quartz).—It is on the North Fork of Tuolumne River, 3 miles W.N.W. from the Confidence Mine. Work was resumed in 1893, after a long period of idleness. John Neal & Co., of Sonora, owners.

*Mount Jefferson Mine* (Quartz).—It is at Groveland. The vein occurs in mica slate, with a dike of granitic character. The property was once a large producer, but has now been idle for years. It is said that the mine will be reopened soon. The vein at one place was 25 ft. wide. The lack of sufficient knowledge of timbering at the time the mine was worked resulted in a disastrous cave. The greatest depth is said to be 265 ft. It is claimed that the ore shoot below this level is intact. J. H. Brown, of Boston, Mass., owner.

*Mount Zion Mine* (Quartz).—It is 1 mile E. of Groveland. Operating in 1893 for a short time, but is now idle. Foot et al., of Groveland, owners.

*Neversweat Mine* (Quartz).—It is 1 mile N.W. of Big Oak Flat, and appears to be the north end of the Mississippi vein. Fault planes are numerous. The gold in this mine occurs in "pockets," always where the main vein is intersected by a seam or "crossing." James Valentine, of Groveland, owner.

*Neversweat Mine* (Quartz).—It is 1 mile N. of Columbia. It is a "pocket" mine also, and is worked by Peterson & Keefe, of Columbia, owners.

*New Albany Mine* (Quartz).—It is 1 mile N.E. of Summersville, in the cañon of the North Fork of the Tuolumne River. See our VIIIth, Xth, and XIth Reports, pp. 665, 752, and 497. The mine was reopened in 1893. — Ballard et al., lessees.

*New Year's Mine* (Quartz).—About 1 mile S.E. of Summersville. It is on the "east lode."

*North Fork Mine* (Quartz).—It is 3 miles E. of Soulsbyville. The vein has a curving strike where developed, the bow being to the south. At either end of this crescent-shaped vein the dip is considerably greater than in its center, where it is  $45^{\circ}$ . All the workings on this vein show the quartz to have been cut off at a common plane. The fault appears to extend through the hill to mines on the opposite side. A new shaft was being sunk in 1893, and it is reported that the vein has been found below the fault. Should this prove to be the case and the quartz rich enough to pay, it may result in several mines being reopened which were rich at the surface, but in which the veins were faulted. The formation in which this mine and other prospects on the mountain occur is mica schist, quartzite, and slates, intruded by felsitic and granitic dikes. Thos. Soulsby, of Soulsbyville, owner.

*North Star Mine* (Quartz).—See Laura Mine. — Oliver et al., of Sonora, owners.



*O'Hara Mine* (Placer).—In Columbia. Working. A. O'Hara & Co., of Columbia, owners.

*O. K. Mine* (Quartz).—One mile N.W. of Jamestown, on the "Mother Lode." R. Chute, of San Francisco, owner.

*Old Tuolumne Mine* (Quartz).—It is in Wet Gulch, 3 miles N.E. of Columbia. A small force of men were engaged in 1893 driving a tunnel, then 1,700 feet long, on the crevice, to reach a shoot of rich quartz which crops on the surface. R. C. Davis, of Columbia, owner.

*Ophir Mine* (Quartz).—This is 1 mile N.W. of Big Oak Flat. It has a very remarkable geological structure. It lies in a nearly horizontal sheet, varying in thickness from an inch to 2 ft. The crevice intersects slates which are nearly perpendicular, striking N. 75° W. A fault has displaced this horizontal vein, dropping the east side nearly 3 ft. The direction of this fault plane is nearly parallel with the strike of the slates. The gold is found in the crushed quartz and slaty rock in the small space between the ends of the displaced vein. In addition to the coarse gold of the "pockets," considerable high-grade milling rock is found. J. P. James, of Groveland, owner.

*Page Mine* (Quartz).—It is 1 mile N. of Sonora, on the west side of Bald Mountain. It is leased for a term of years by the Bald Mountain Tunnel Company, of Sonora. The rocks are partly metamorphic, mica schist, slate, quartzite, etc., and partly eruptive, diorite-porphyrite, and felsitic dikes. These latter accompany the vein. The fissure varies from a seam to 3 ft. in width. Aside from the pockets the quartz is absolutely barren. As usual in "pocket mines," the gold is found where seams intersect the main vein.

The most valuable deposits have been found where a nearly horizontal seam cuts the fissure at points where a nearly vertical seam strikes across the vein. In nearly all the pocket mines in this portion of California, the gold occurs at points where three planes intersect, viz.: the main crevice; a seam having a strike parallel or nearly so by cutting the vein in dip; and a crossing seam striking at a high angle across the main fissure, though having a greatly varying dip. The most productive are those which approach the vertical. It is true there are exceptions, but the conditions stated constitute the rule. On the other hand these favorable conditions obtain at times and no gold is discovered. The dike rocks also appear to influence the deposition of the gold. In several cases in the Page Mine gold was discovered attached to the felsitic dike rock.

Other pocket mines on Bald Mountain having characteristics similar to the Page Mine are the Ford, Garrett, Sugarman, and Wilson. Prospectors are always traversing this section of the country in search of pocket mines, which are usually discovered by prospecting the surface soil.

*Patterson Mine* (Quartz).—At Tuttletown, 3 miles N.W. from Jamestown. See our VIIIth Report, p. 656.

*Piute Mine* (Quartz).—It is a "prospect," near the Henrietta. It is bonded and being developed. C. F. Haslam, of Sonora, owner.

*Philadelphia Diggings* (Hydraulic).—They are 10 miles N. of American Camp, and enjoyed a long season of prosperity, but have been closed down for years. W. H. Sharp & Co., of San Francisco, owners.

*Platt & Gilson Mine* (Quartz).—This is in the town of Soulsbyville. See our VIIIth and Xth Reports, pp. 666 and 746. W. Sharwood, of Soulsbyville, owner.

*Puerto Fino Mine* (Quartz).—This is near the village of Cherokee. See our XIIth Report, p. 499. W. Sharwood, of Soulsbyville, owner.

*Rappahannock Mine* (Quartz).—It is  $1\frac{1}{2}$  miles N.W. of Jamestown, on the "Mother Lode." R. Chute, of San Francisco, owner.

*Rawhide Mine* (Quartz).—It is  $2\frac{1}{2}$  miles N.W. of Jamestown, on the Rawhide ranch. See our Xth and XIth Reports, pp. 54 and 507. Since our last report the main shaft has been sunk to the 400 ft. level, and levels run. Very rich rock was struck during the fall of 1893. The new 40-stamp mill has been completed, and it is thoroughly equipped with all modern machinery. It is run by water, but with a very light pressure. Guild Gold Mining Company, owners; W. E. Nevills, of Jamestown, manager.

*Rawhide Mine No. 2* (Quartz).—It lies S.E. of the Rawhide. It is undeveloped. Hayward & Hobart (estate), of San Francisco, owners.

*San Guiseppe Mine* (Quartz).—It lies 1 mile W. of Sonora. See our VIIIth and Xth Reports, pp. 654 and 740. It is in active operation. Excepting additional development, the conditions at the mine are much the same as when last reported. The ore shoots occur in altered diorite-porphryite, and are without well-defined walls or limits. This mine produces the purest vein gold in California. San Guiseppe Mining Company, of Sonora, owners.

*Santa Maria Mine* (Quartz).—It is 20 miles S.E. of Groveland, on the Yosemite road, near Crocker's Inn. It has an 18 in. vein of high-grade quartz. John Neale, of Sonora, owner.

*Saratoga Mine* (Quartz).—This is about half a mile N.W. of Sonora. See our Xth Report, p. 737. The fissure is a simple crevice, cutting slates, schists, quartzite, limestone, and diorite dikes, being accompanied by a light-colored felsitic dike. The vein strikes N.  $40^\circ$  and dips  $65^\circ$  to  $70^\circ$  N.W. The country rocks strike N.  $25^\circ$  W. and dip N.E. Although the vein cuts several varieties of argillaceous, calcareous, silicious, and magnesian rocks, gold is only found in the vein where it cuts the black slates. The fissure is a plane of displacement, the rocks of the foot-wall being found on the hanging-wall side 30 ft. southwestward. The usual "gold seams," parallel with the vein, and cutting it in dip, and the "crossings" which lie parallel with the slates, are always found accompanying "pockets" in this mine. J. T. Faxon, of Sonora, owner.

*Silken Mine* (Quartz).—This is 1 mile N.W. of Big Oak Flat. The vein, striking N. and dipping  $42^\circ$  W., has a "shoot" in which "pockets" occur, and it is 30 ft. long, 1 to 5 ft. wide, and pitches  $45^\circ$  N. In depth the vein becomes much flatter. The slates strike E. and W. and dip  $80^\circ$  S. The usual "gold seams" and "crossings" occur. C. P. Hall, of Big Oak Flat, owner.

*Sonora Consolidated Mine* (Quartz).—It is  $1\frac{1}{2}$  miles E. of Cherokee. See our Xth Report, p. 748. John Neale, of Sonora, owner.

*Soulsby Mine* (Quartz).—It is in Soulsbyville. See our Xth Report, p. 742. It was still idle in 1893, but there was some talk of reorganization and reopening this once famous mine, which has been one of the most important on the "east lode." The vein is in hornblende granite, and a dike of light-colored rock, having a felsitic texture, accompanies the vein. W. Sharwood, of Soulsbyville, owner.

*Sugarman Mine* (Quartz).—See Page Mine. J. H. Neale, of Sonora, owner.

*Todd & Hunter Mine* (Quartz).—See Hunter Mine.

*Virginia Mine* (Quartz).—See Virginia Consolidated Mine.

*Wheeler Mine* (Quartz).—In Big Oak Flat; worked intermittently. See Cosmopolite. O. Fisk, of Coulterville, Mariposa County, owner.

*Wilson Mine* (Quartz).—See Page Mine.

*Winchester Mine* (Placer).—In Columbia. Working. Julia Winchester, of Columbia, owner.

#### TRINITY COUNTY.

On account of the comparatively small amount of agricultural land along the rivers of this county, and their emptying directly into the ocean, the numerous gravel deposits have been worked without hindrance by the hydraulic process, keeping the gold output of the county up to a high figure. Within the last year foreign capital has been brought in for the development of the heavier bodies of gravel. The quartz developments have not kept pace with the gravel workings. This is not so much from an absence of profitable mineral-bearing veins as from the roughness of the country and the lack of good wagon roads through the mountain districts, which add greatly to the expenses of acquiring the necessary machinery for the reduction of ores. The success of the Brown Bear and adjacent mines shows what may be expected in this direction when more thorough prospecting has been done. Closer prospecting along the serpentine belt that passes through the country past the Altoona Quicksilver Mine toward Salmon River will undoubtedly reveal further bodies of cinnabar; its presence is plainly indicated near the Black Bear Mine, in Siskiyou County, although the ore in place has not been developed. For the genuine prospector this is a field that should well repay a careful and thorough investigation.

*Bartred Mine* (Quartz).—See our VIIIth Report, p. 638.

*Begel & Day Placer Mine* (Hydraulic).—This claim is on Cañon Creek, half a mile S. of Dedrick. Messrs. Begel & Day, of Dedrick, owners.

*Berger Claim* (Hydraulic).—This is 4 miles S. from Dedrick, on Cañon Creek. — Berger, of Dedrick, owner.

*Bloss & McClary Mine* (Hydraulic).—See our Xth Report, p. 699. It is at Trinity Center, and comprises 600 acres of ground. Only 300 acres of this ground can be worked without elevating, and the dumping ground for that amount is not favorable, being only 40 ft. The present bank is about 80 ft. high, with 800 ft. frontage, carrying from 12 to 20 ft. of gravel and soil capping. A part of the gravel next to the bedrock in the deeper portions of the channel is cemented, and a stratum of sandstone shows in portions of the bank. Water to the amount of 600 in. is conveyed through an upper ditch 7 miles long, and 1,600 in. through a lower ditch 2½ miles long; 900 ft. of pressure may be had, but only 300 ft. are made use of. There are 1,700 ft. of 13 in. pipe and one "giant" with 5 in. nozzle. The season lasts from May to September, working one shift. Besides the bedrock cut, there are 82 boxes of 6 ft. tail flume, on a 3½ in. grade to the box, paved with block riffles. Messrs. Bloss & McClary, of Trinity Center, owners.

*Bonanza Mine* (Quartz).—This is on the west side of Bully Choop Mountain, 45 miles W. from Anderson, at an altitude of 5,200 ft., and comprises 4,500 by 600 ft. The vein, 4½ to 5 ft. wide, courses E. and W. and dips N., between a slate hanging-wall and a diabase foot-wall.

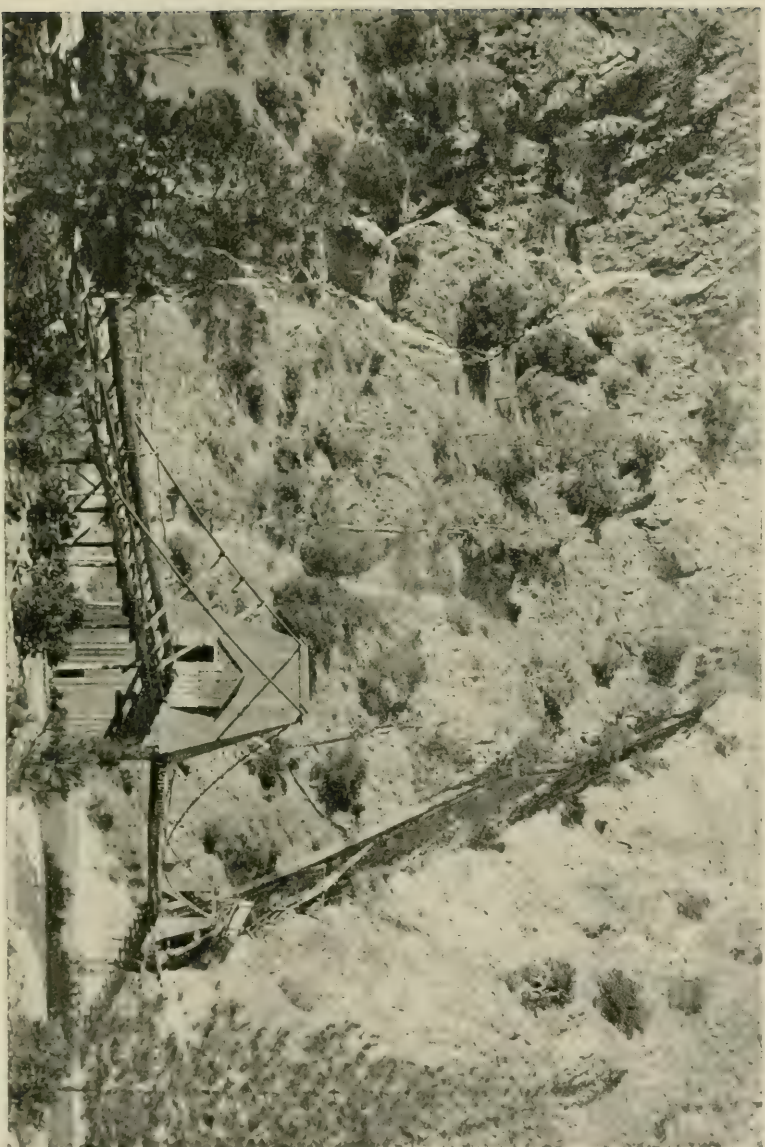


There are two tunnels, respectively 100 and 300 ft. long, and giving 50 and 100 ft. backs. The ore is of a good grade and carries 3 per cent of sulphurets. A  $3\frac{1}{2}$  ft. Huntington mill, half a mile from and 700 ft. lower than the mine, is run by an 8 ft. hurdy wheel under 200 ft. pressure. The ore is sledged from the mine to the mill, which has a capacity of 10 tons in twenty-four hours, and is supplied with a 10 ft. apron set on a  $1\frac{3}{4}$  in. grade to the foot; also a Triumph concentrator. A furnace is in course of construction. Hart Bros., of Agland, owners.

*Brown Bear Mining Company's Mines* (Quartz).—See our VIIIth, Xth, and XIth Reports, pp. 639, 713, and 483. They are 9 miles W. of French Gulch, in T. 33 N., R. 8 W., and consist of the Last Chance, Monte Cristo, and Brown Bear, besides others of less importance, covering in all more than 200 acres. The two latter are on the same vein, and the former is parallel at a distance of 180 ft. The vein courses E. and W. and dips  $40^\circ$  N. The ore bodies vary in width from almost nothing to 10 ft., with granite on the north and slate on the south. The principal works at present are on the Last Chance and Monte Cristo. There are four working tunnels beneath one another, about 100 ft. apart, and all connected; it is the same with the Monte Cristo. The principal tunnel on the Last Chance runs on the vein 5,000 ft. in length. The mine requires heavy timbering, and what is quite a drawback the ore is handled repeatedly before it reaches the mill. There is a 15-stamp mill connected with the property, carrying 700 lb. stamps. The ore is passed over a grizzly, the bars 2 in. apart; then through a Hendy crusher into the ore-bins leading to Hendy self-feeders. The stamps are dropped 3, 1, 5, 2, 4, at the rate of 92 per minute,  $5\frac{1}{2}$  in. drop, with a discharge varying from  $6\frac{1}{2}$  to 7 in., through a No. 10 slot screen, giving a duty of  $1\frac{1}{2}$  tons per stamp in twenty-four hours. The mortar has front and back plates on the inside; the apron plates are 12 ft. long and 18 in. wide. Two Frue and two Triumph concentrators handle all the pulp. The concentrates are sent to chlorination works a mile below the mill. The plates are only scraped when the batteries are cleaned up, and yield 10 per cent of the amalgam, as against 90 per cent obtained from the batteries. Fifty-five men are employed. C. H. Watt, John Melton, and Mrs. H. Martin et al., of Deadwood, owners.

*Bully Chooop Mine* (Quartz).—This is on the west side of Bully Chooop Mountain, and comprises several claims. The principal vein courses E. and W. with a nearly vertical dip, and averages  $1\frac{1}{2}$  ft. in width, between slate and porphyry walls. Developments consist of a shaft sunk on the vein and a tunnel run to tap the shaft, besides some open cuts along the surface. One and a half miles from and 1,000 ft. below the mine is a 5-stamp mill and two arrastras, run by water power, to which the ore is hauled on small narrow-gauge wagons. The quartz is high grade, and carries about 3 per cent of sulphurets of iron and copper. Messrs. G. A. Grigshy and — Johnson, of Agland, owners.

*Campagnie Française de Placers Hydrauliques* (Hydraulic).—This claim is half a mile W. of Junction City, and comprises 1,300 acres. The gravel bank is part of a former bench of the drainage when on a higher level, about 200 ft. above the present river. Five such benches have been noted; on the second bench above the present river bed the most platinum is found in the gravel on cleaning up. There are two pits in operation, the height of the respective banks being 150 and 40 ft., with about 35 ft. of genuine gravel and a soil capping; the entire bank up to the grass roots is gold-bearing. Six "giants" are in use in



Pipe-Line and Bridge, across Trinity River, of the Cie. Française des Placers Hydrauliques, Trinity County





one pit, with 6 in. and 7 in. nozzles, and one with an 8 in. nozzle in the other; they work under 160 ft. pressure. Water is obtained through 11 miles of ditch from Cañon Creek and 2 miles of ditch from Mill Gulch. The faces of the bank are 2,200 and 1,600 ft. long, respectively; the duty of the water per day is 2 cu. yds. of dirt per miner's inch. The gravel is free, there being no clay and no big boulders, resting on slate bedrock, and carrying cucumber-seed gold. Drifts are run and the bank blasted to increase the duty; about 900 lbs. of powder are consumed each month. The mine is run day and night during the water season of eight months; the remainder of the year is taken up with cleaning bedrock. The gravel is washed through bedrock cuts  $4\frac{1}{2}$  and 5 ft. wide, 900 and 300 ft. long, on an 8 in. grade, paved with blocks; besides these, 2,000 ft. of sluices are used, set on a 5 in. grade. The first 250 ft. of flume is cleaned up every fifteen full working days. Quicksilver is used in the boxes, and the gold is .915 fine. The company have their own sawmill on the ground; its blocks costing \$10 per thousand feet, board measure. Telephones and electric lights are being put in place, and new water sources are to be tapped to enable the work to continue day and night the year round. There are 44 men employed at \$2 50 per day, board being furnished at \$20 per month. F. Heurtevant, of Junction City, manager.

*Chapman & Fisher Mine (Hydraulic).*—See our Xth Report, p. 708.

*Chinese Gravel Claim (Hydraulic).*—It is at Trinity Center, adjoining and partly in front of the Bloss & McClary claim, and on the same channel. The bank is 150 ft. high, with about 20 ft. of partly cemented gravel next the slate bedrock. One 5 in. giant is used under a pressure of 60 ft. head. The 4 ft. flume is paved with wooden blocks, is over a mile in length, and dumps into Trinity River. The gold is cucumber-seed shaped, and worth \$18 per ounce. The ground is nearly worked out. Chinese Company, owners.

*Chloride Mine (Quartz).*—This is  $2\frac{1}{2}$  miles N.E. of Dedrick, at the head of Cañon Creek, and comprises seventeen locations with four veins; the main one courses N.  $7^{\circ}$  E., dips  $30^{\circ}$  S., between syenite walls, 3 to 6 ft. apart. The present developments consist of three tunnels, one on each of the three claims: the Chloride, Big Bally, and Little Bally, all cross-cuts. The Chloride main tunnel cuts the vein at 80 ft., then turns on the vein 100 ft.; the Big Bally has 40 ft. of cross-cut tunnel and 120 ft. on course of the vein; the Little Bally has a 70 ft. cross-cut to the vein. On the Chloride they have 125 ft. of backs, which increase rapidly going into the hill. The quartz carries a good percentage of sulphurets, including galena. The Big Bally has a large proportion of iron sulphurets. The Little Bally has opened up a feeder about 3 in. wide making to the main vein, and prospecting about \$60 per ton. Timber is rather scarce, though there is a plentiful supply below. A  $3\frac{1}{2}$  ft. Huntington mill, run by a 3 ft. Pelton wheel under 175 ft. pressure, is a mile below the mine, to which the ore is hauled on sleds, carrying  $1\frac{1}{2}$  tons per load, and making four trips per day. Ores under \$10 do not pay to handle; freight from Dedrick P. O. is \$3 per mule load. The altitude at the mine is over 5,000 ft. Miners' wages, \$2 and board. The mill only runs during the day, and crushes 6 tons through a No. 40 slot screen. A peculiar arrangement of the feed passes the ore through the self-feeders before passing through the crusher, from which it is dropped immediately into the mill. Below the mill are two 10 ft. aprons,  $4\frac{1}{2}$  ft. wide, set on a  $1\frac{1}{2}$  in.

grade to the foot, but no appliances for saving the sulphurets, which are said to assay well. The plates are scraped every day and the mill cleaned up once a month. The property is leased. C. W. Smith et al., of Weaverville, owners.

*Cleveland Consolidated Gold Mine (Quartz).*—This is on the S.W. side of Bully Choop Mountain, at an elevation of 5,500 ft., and comprises nineteen full claims. The main vein, averaging 7 ft. in width, courses N. 15° W., between a slate hanging-wall and a diabase foot-wall, with a dip to the E., varying in its pitch, being flatter near the surface. Developments consist of a tunnel run in on the ledge a distance of 350 ft., and about 250 ft. below the croppings, connected with the mill by an incline tramway 700 ft. long. The quartz, which is mostly high grade, appears to be formed by replacements, and carries some lime. A large percentage of the gold is float gold, which presents difficulties in milling, a very large portion of the assay value going off with the slimes. The present milling method passes the ore over grizzlies set to 1½ in. openings between bars, through a Dodge rockbreaker and Hendy self-feeder. The 10 stamps weigh 750 lbs. each, and drop 93 times per minute, with a 6 in. drop and 5 in. discharge, using No. 20 slot screens. The apron is 4 by 12 ft., set on a ¾ in. grade to the foot. The pulp passes direct from the aprons onto the six Triumph concentrators. The quartz carries 6 per cent of sulphurets, mostly iron and copper; these are roasted in a 60 ft. reverberatory furnace furnished with three steps, and later amalgamated in a revolving barrel, making about 22 revolutions per minute. The pulp is discharged into a tub and washed out with a hose over silver plates and through traps. The results are fairly satisfactory and cheaper than the chlorination, which was formerly practiced. These silver plates are set on a grade of 1 in. to the foot. The principal apron plates are scraped once in twenty-four hours, and produce 80 per cent of the amalgam saved. The entire mill is cleaned up once a month. A 37 horse-power engine requires daily 5 to 8 cords of wood, costing \$3 per cord. Wages are \$2 25 per day; freight from the railways is 1 cent per pound. R. G. Hart, Jr., of Agland, owner.

*Danbrink Claim (Hydraulic).*—It is 4 miles S. from Dedrick, on Cañon Creek. — Danbrink, of Dedrick, owner.

*Enterprise Mine (Quartz).*—See our VIIIth Report, p. 643.

*Globe Mine (Quartz).*—This is 5 miles N.E. from Dedrick, at an elevation of 5,500 ft., and comprises seven claims. The veins are parallel, and course N.E. and S.W. and dip about 60°. The main vein is 3½ to 13 ft. in width, with porphyry and mica schist walls. The quartz carries several per cent of sulphurets, mostly iron. The mine is developed through tunnels, all run on the vein. No. 1, the lowest, is 80 ft.; No. 2, 128, and No. 3, 265 ft. in length, with an upraise of 126 ft. to the surface. The No. 2 is the main tunnel at present; a chute on the outside conveys the quartz to a tramway that delivers in the mill. The mine is extremely favorably situated for development through drifting, gaining 1 ft. in depth in every 3 ft. in length. The timber is all below the level of the mine and has to be packed on mules. Freight from Dedrick, by pack animals, is 1 cent per pound. Lumber costs \$50 per thousand feet. A 3½ ft. Huntington mill, with an output of 5 tons per twenty-four hours, is run by a 7 horse-power engine, consuming 1 cord of wood daily. The water for the mill is obtained partly from a spring and partly from a neighboring gulch. The apron plate is 10 by 5 ft. A No. 60 steel wire

screen is used, also a self-feeder and a rockbreaker, but no concentrators. The mine is closed at present through litigation. R. Woodburn, of Dedrick, owner.

*Gold Leaf and Great Eastern Mine (Quartz).*—This is 10 miles W. from Castella by trail, and comprises 3,000 by 600 ft. The vein courses N.W. and dips 45° S., and has a width of 2½ to 4 ft., between porphyry walls. The quartz carries little sulphurets. The developments consist of a tunnel on the vein 125 ft. long. Wood and water are plentiful in the neighborhood of the mine. J. N. White et al., of San Francisco, owners.

*Golden Chest Mining Company's Mine (Quartz).*—See our VIIIth Report, p. 641.

*Good Friday Placer Mine (Hydraulic).*—This is 3 miles S. of Junction City, and comprises 80 acres. The mine is on a bench; the bank is from 60 to 70 ft. in height. The mine obtains its water supply from a neighboring gulch and uses a No. 1 "giant"; the water season is short. T. C. Post and T. E. Jones, of Junction City, owners.

*Gribble's Placer Claim (Hydraulic).*—It is 3 miles S. of Junction City, and comprises 100 acres. The work is at a standstill at present, on account of the caving away of the upper ditch. The bank is from 35 to 90 ft. in height, with 15 ft. of gravel on the second bench from present river level. It is worked through an open cut, 300 ft. long, carrying a 3 ft. flume supplied with block and cross riffles. One "giant" with a 4 in. nozzle is used. The water season lasts six months. The gold sells for \$17 50 per ounce, and is fine and scaly, and associated with some platinum. Mrs. Gribble, of Junction City, owner.

*Haas Mine (Hydraulic).*—See our Xth Report, p. 703. It is 1 mile S.E. from Junction City, and comprises 160 acres of patented ground. The bank is 40 ft. high, with about 600 ft. face, and 16 ft. of gravel on the bedrock and a capping of loam and pipe-clay. The gravel prospects throughout in fine scaly gold, which sells at \$17 75 per ounce. Two "giants" with 6 in. nozzles are used, and supplied through 3,500 ft. of 15 in. pipe. The water is furnished from Clear Gulch, a tributary of Cañon Creek, through 7 miles of ditch, carrying 1,800 in. and delivered under 370 ft. pressure. The season lasts from December to July. There are 100 flume boxes 4 by 3 ft., paved with 8 in. blocks and set on 4½ to 6 in. grade. One undercurrent, 12 by 48 ft., is filled with Hungarian riffles. The blocks cost 2 cents per foot, board measure; lumber costs \$20 per thousand feet, and has to be hauled 4 miles. The bedrock is slate; the channel is a former bed of the present drainage area at a higher level. Three acres have been worked off in all. The tailings are dumped at the edge of Trinity River. F. G. Haas, of Junction City, owner.

*La Grange Mining Company's Mine (Hydraulic).*—This claim is on Oregon Gulch, 4 miles west of Weaverville, and comprises over 400 acres. The gravel bank worked at present has the characteristic of a glacial deposition; the pit is about 245 ft. deep, carrying gravel throughout, with the gold distributed from top to bottom; the distance across the pit is about 1,200 ft. Three "monitors" are in use, two 15 in. and one 7 in. nozzle, working under 260, 400, and 440 ft. heads. The pipe-lines contain 1,200 ft. of 15 in., 2,500 ft. of 18 in. reducing to 15 in., and 200 ft. of 22 in. reducing to 18 in. Two derricks are used, capable of lifting 4 tons, and have a reach of 90 ft. Last year 3 tons of



powder were used in blasting. The water supply is derived as follows: 3,000 in. from the Rush Creek ditch,  $14\frac{1}{2}$  miles long, and 1,500 in. from the West Weaver ditch, 4 miles long; the season lasts from December to September. At present 400 ft. of 6 ft. wide sluice-boxes are used, set on a grade of 1 in. to the foot, and paved partly with rock and partly with wooden blocks, costing \$7 per thousand. One undercurrent, 18 by 48 ft., with three compartments, set on a grade of 13 in. to 12 ft., and paved with rocks and blocks, is used. Lumber has to be hauled 4 miles. A clean-up is made when the blocks are worn out. The debris is dumped into Oregon Gulch. At present 37 men are employed, who receive \$2 50 per day. The gold is largely cucumber-seed gold, although some quartz gold is found, and sells for \$19 25 per ounce. W. H. Radford, of Weaver-ville, Superintendent.

*Last Chance Mine* (Quartz).—See Brown Bear Mine.

*Lewis & Keenan Claim* (Hydraulic).—This is a bar on Cañon Creek, 1 mile S. from Dedrick. Lewis & Keenan, of Dedrick, owners.

*Loman & Wyld Claim* (Hydraulic).—This is on Indian Creek, 1 mile from its mouth and 3 miles from Douglas City; it consists of 20 acres of an old bar. The bank, which carries from 10 to 30 ft. of gravel, is just being opened; the water supply is obtained from a dam 22 ft. high, about 1 mile up Indian Creek; the ditch carries about 300 in. of water. A No. 2 giant and 450 ft. of 15 in. pipe are in use. The 3 ft. flume of 15 boxes is lined with blocks; no undercurrent. Blocks cost 1 cent per foot, board measure; lumber, which has to be hauled 15 miles, is worth \$25 per thousand feet, and general freight costs  $1\frac{1}{8}$  cents per pound from railroad. The gold is .920 fine. Loman & Wyld, of Douglas City, owners.

*Mahoney & Wallace Mine* (Hydraulic).—It is on Cañon Creek, three fourths of a mile from Dedrick P. O. Mahoney & Wallace, of Dedrick, owners.

*Maple Gold Mine* (Quartz).—It is  $1\frac{1}{2}$  miles S.E. from Dedrick, near Cañon Creek, and consists of five claims. The vein courses N.W. and S.E., varying in width from 8 to 12 ft., between porphyritic and green-stone walls. It carries a large percentage of sulphurets, which are not saved, as the present works are for prospecting only. The ore is reduced in a 10 ft. arrastra run by water power. Developments consist of a main working tunnel cross-cutting for 90 ft., then turned 180 ft. on the vein, giving 150 ft. of backs. A second tunnel, 70 ft. above, is drifted 90 ft. Water power is obtained from the East Fork of Cañon Creek, through a ditch  $1\frac{1}{8}$  miles long, giving 80 ft. pressure. D. L. Smith, of Dedrick, owner.

*Mary Jane Gold Mine* (Quartz).—This is  $2\frac{1}{2}$  miles N.E. from Dedrick, and comprises two full claims. The vein courses N.E., dips  $70^{\circ}$  E., and is 2 to 8 in. wide, between a mica schist hanging-wall and a porphyry foot-wall. The mine is just being opened by a tunnel, at present 30 ft. long. Ralston & Spenser, of Weaverville, owners.

*McMurray & Hupp Gravel Mine* (Hydraulic).—See our Xth Report, p. 701. This is in Sec. 7, T. 33 N., R. 9 W., half a mile below Weaver-ville, and comprises 96 acres of patented land. The gravel deposit is 40 ft. deep. McMurray & Hupp, of Weaverville, owners.

*Minersville Placer Mining Company's Mine* (Drift).—This is  $1\frac{1}{2}$  miles E. from Minersville, and comprises 160 acres. The company is drifting for a channel supposed to run N. and S. They have penetrated slate

bedrock 180 ft., and expect to strike the channel in 40 ft. more. J. C. Bolton et al., of Minersville, owners.

*Monte Cristo Mine* (Quartz).—See Brown Bear Mine.

*North Star Mine* (Quartz).—See our VIIIth Report, p. 642.

*Oro Grande Mine* (Quartz).—It is in Hostetter Gulch,  $6\frac{1}{2}$  miles N.E. from Trinity Center, and comprises six claims. The vein courses S.E., dips about  $72^\circ$  N.E., on a contact of serpentine with slate; the vein averages 3 ft. in width. The mine developments consist of three tunnels; No. 1, 125 ft. long and 200 ft. above No. 2, which is 350 ft. long and 147 ft. above No. 3, and this 140 ft. long; the two latter are connected by an upraise. Three quarters of a mile below the mine, at the foot of a steep hill, is the 5-stamp mill, run by an improved Leffel 13 in. turbine, supplied with water from Trinity River, under 27 ft. pressure. The stamps drop 85 times per minute,  $5\frac{1}{2}$  in. drop, 7 in. discharge, through a No. 8 slot screen, and have a duty of  $1\frac{1}{2}$  tons per stamp per twenty-four hours. The apron is 10 ft. long on  $1\frac{3}{4}$  in. grade to the foot. Cost of mining is \$1 per ton, hauling on sleds 75 cents per ton, and milling \$1 25 per ton. Cost of lumber, \$18 per thousand feet. The mine can produce 50 tons per day with 25 men. Stroude Bros., of Trinity Center, owners.

*Paulsen Gravel Mine* (Hydraulic).—This is on Trinity River, 6 miles W. of Deadwood, and comprises over 600 acres. This is a new undertaking, engaged at present in bringing in water from Grass Valley Creek. One of the bodies of gravel is over 400 ft. deep, and it has a dump of 400 ft. to the Trinity River. The other bodies carry from 7 to 12 ft. of gravel. P. M. Paulsen, of Weaverville, owner.

*Red Hill Mine* (Hydraulic).—See our Xth Report, p. 706.

*Sheridan Placer Mine* (Hydraulic).—This is on Trinity River, 2 miles S. of Junction City, and comprises 104 acres of patented ground on a former bar of the river. The gravel bank, with soil capping, is from 15 to 20 ft. high, with 600 ft. face. The pit is being worked through 500 ft. of bedrock flume, with 4 in. grade to 12 ft., dumping onto a bar of Trinity River. The water supply is obtained from Simpson's Gulch through two ditches, each half a mile long, carrying 600 and 150 in. respectively, delivering it into a reservoir, which is intermittently emptied. Seven acres have been worked off with a No. 1 giant, using a 3 in. nozzle under a 200 ft. head and 1,600 ft. of pipe, reducing from 11 in. to 7 in. Season lasts six months. Sheridan Bros., of Junction City, owners.

*Silver Gray Mine* (Quartz).—It is  $2\frac{1}{2}$  miles E. from Dedrick, and comprises five claims. The vein is 8 in. to 6 ft. wide, courses N.E. and dips  $75^\circ$  S., between syenite walls. The developments consist of cross-cut tunnel No. 1, 60 ft. long and turned 80 ft. on the ledge, which shows an average width of 2 ft.; 400 ft. west is tunnel No. 2, which it cross-cuts 70 ft. and turns both ways on the vein 144 ft., and is 140 ft. below No. 1. Tunnel No. 5, 50 ft. lower than No. 2, is just being opened on a new ledge, from 1 to 3 ft. wide. A 5 ft. Huntington mill, running night and day, crushes 12 tons; the quartz carries  $1\frac{1}{2}$  per cent of sulphurets of a fair grade. The mine has lately changed hands.

*Swift & Co.'s Claim* (Hydraulic).—It is 4 miles N.E. of Douglas City, and comprises 80 acres. The bank, which is a part of the former river bed, is from 30 to 70 ft. high and is worked with a "giant" and 450 in. of water from Weaver Creek. Thirty 4 ft. flume boxes are used, set on

grades varying from 3 to 6 in., which are cleaned up three times during the season. The gold is .875 fine. Swift et al., of Douglas City, owners.

*Trinity Gold Mining Company* (Hydraulic).—See our VIIth Report, p. 638.

*Trinity River Hydraulic Mining Company's Claim* (Hydraulic).—This is on the Trinity River,  $3\frac{1}{2}$  miles N.W. from Douglas City, and comprises 360 acres. The gravel deposit is the former bench and bed of the river, showing a bank 100 ft. high and 300 ft. wide, with 20 ft. of gravel; the exact width of the deposit is not known, as the work has been mostly confined to a bench. In the main part of the channel the gold is evenly distributed throughout, while on the bench it is best next to the bedrock. Two "giants" are used under a 175 ft. head, supplied with 500 in. of water through 500 ft. of 15 in. iron pipe. Reading Creek furnishes the water, and the season lasts eight months. The property is worked through bedrock cuts, with several sections of 3 by 3 ft. flume, having a total length of 480 ft., set on a 9 in. grade to the box, and paved with wooden blocks. One undercurrent is used, 14 ft. wide by 30 ft. long, set on a grade of 1 in. to one foot, and paved with small blocks. The tailings dump on a bar of Trinity River. The gold is of the cucumber-seed kind, and has a fineness of .930; wages \$2 per day and board. A. S. Dunbar, of Douglas City, Superintendent.

*Trinity River Tunnel and Mining Company* (Hydraulic).—See our Xth Report, p. 709.

*Union Hill Claim* (Hydraulic).—This is one fourth of a mile N.E. of Douglas City, and comprises 230 acres. The property is opened through 800 ft. of tunnel to the river. The bank is 30 to 90 ft. in height, and has a clay and soil capping; animal remains (bone and teeth) have been found in the gravel. There are 400 ft. of ditch, and water is delivered under 80 ft. pressure. Gold, .900 fine. Mason & Thayer, of Douglas City, owners.

*Yellowstone Mine* (Quartz).—See our Xth Report, p. 711. This is at Coleridge, on the East Fork of the North Fork of Trinity River, and comprises eight claims. The main veins are *North Star* and *Yellowstone*. The former is 4 ft. wide, and courses N. and S., and dips about  $45^{\circ}$  W., between granite and greenstone walls. Developments on the Yellowstone consist of a cross-cut tunnel 400 ft. long, turned south on the vein 200 ft., with an upraise to the surface. In an intermediate tunnel from the upraise, a 3 ft. ledge of ore is now being opened. There is a 10-stamp mill on the property, run by a 4 ft. Pelton wheel under 85 ft. pressure. The stamps, which weigh 850 lbs. each, drop 6 in. 90 times per minute, having a 9 to 10 in. discharge through a No. 10 slot screen. The mortar is provided on the inside with front and back plates and an outside apron plate 5 by 10 ft., set to a grade of  $1\frac{1}{2}$  in. to the foot. The sluice plates are 16 ft. long and 24 in. wide, on the same grade as the apron plate. The tailings are said to assay 73 cents per ton. Yellowstone Mining Company, owners; W. T. St. Aubyn, of French Gulch, Superintendent.

#### VENTURA COUNTY.

*Bunker Hill Mine* (Quartz).—It is on the western slope of Frazer Mountain. It is developed by tunnels and open cuts, exposing a large ledge of disintegrated quartz. The vein has a N.W. course. It has associated with it a narrow stratum of mica schist, that and the vein



being inclosed between dikes of a beautiful augen gneiss. Gold is found not only in the quartz but in the crushed portions of the walls. Haylock Bros., of Ventura, owners.

*Castac Mine* (Quartz).—It is on Piru River, in the Snowy District, about 10 miles S. of Gorman Station. The veins have a N.W. course, dipping to the N.E. The country rock is quite varied, though everywhere more or less schistose. It is clearly exposed in the walls of the cañon opposite the mill, where it seems to vary from a hornblende schist to a syenite gneiss with a knotty appearance. The main tunnel has an elevation of 600 ft. above the river, and so precipitous is the cañon that a cable has been stretched from the dumps down to the mill on the opposite side of the creek. Down this cable the ore is lowered as fast as it can be crushed. There are 3,000 ft. of tunnels and upraises. The vein varies greatly in size, but averages  $3\frac{1}{2}$  ft. It is partly free milling and partly sulphuret ore. See our VIIIth Report, p. 683. A. Fraser, of Gorman Station, owner.

*Fairview Mine* (Quartz).—It is on a vein inclosed in augen gneiss, and adjoins the Bunker Hill. Two tunnels have been run; the upper one 290 ft. and the lower 130 ft. long. In addition to gold, there is found silver-bearing galena in a dolomitic matrix. The galena is sometimes found in large masses. The gold occurs both free and associated with sulphurets. The ledge matter is cut by a network of brown iron veinlets. A mill is soon to be erected. Haylock Bros., of Ventura, owners.

*Frazer Mine* (Quartz).—This is on the steep southern slope of Frazer Mountain, a few hundred feet below the summit. It is the most easterly of the deposits on the mountain. The veins have a N.W. course, conforming to the schistose structure of the country. The rock varies from a hornblende schist to a syenite gneiss, the latter often showing the peculiar character of augen gneiss. The veins are contained in a zone 200 ft. wide, in which the rock is greatly crushed. All the quartz carries gold, and though the workings have not been systematically developed, there are in sight large bodies of ore. The mine has been worked for many years, and is reported to have produced a large amount of gold. See our VIIIth Report, p. 682. E. P. Chilsen, of Gorman Station, Superintendent.

*Montecito Gravel and Quartz Company* (Placer).—The deposits of gravel on which this company is at work extends along the north side of Piru River, from about  $2\frac{1}{2}$  miles above the mouth of Lockwood Creek to its head, and also in San Quelmo Cañon, a tributary of Lockwood Creek. The average width is said to be 3 miles. Sluicing and rocking have been carried on intermittently here for many years. The gold is coarse and not much worn. The gravels lie in the form of terraces, extending in places to the top of the hills between Piru River and Lockwood Creek. They were probably deposited by a Pliocene river heading more toward Mount Pinos than the present Piru. Underneath the gold-bearing gravels is an older deposit of a different character, and barren of gold. It is more firmly cemented and perhaps belongs to the Miocene, which is so strongly developed in this section. In a similar manner, gravels overlie the Tertiary on the flanks of Frazer Mountain and Mount Pinos. On the former mountain they are gold-bearing. The great trouble heretofore has been the lack of water for sluicing. Water is present in sufficient quantities in the Piru, but will have to be brought a number

of miles in order to get the requisite fall. Judge Roberts, of Goleta, President.

*White Mule Mine* (Quartz).—It is on the western slope of Frazer Mountain, a little distance below the Fairview. Here are found three veins dipping to the north. They are separated by dikes of augen gneiss, but in immediate contact with each is a stratum of mica schist. The gold is mostly contained in iron sulphurets, which, in places, form a large part of the vein. A Huntington mill has recently been erected, but the work soon stopped when it was found that the mill was not adapted to the character of the ore, and that very little gold could be saved. See our VIIIth Report, p. 682.

#### YOLO COUNTY.

As is well known, Yolo County occupies one of the most fertile portions of the Sacramento Valley, and the greater part of its area is well adapted to the growth of either grain or fruit. It is nearly all valley land, along the western borders of which there is a fringe of mountains belonging to the Coast Range.

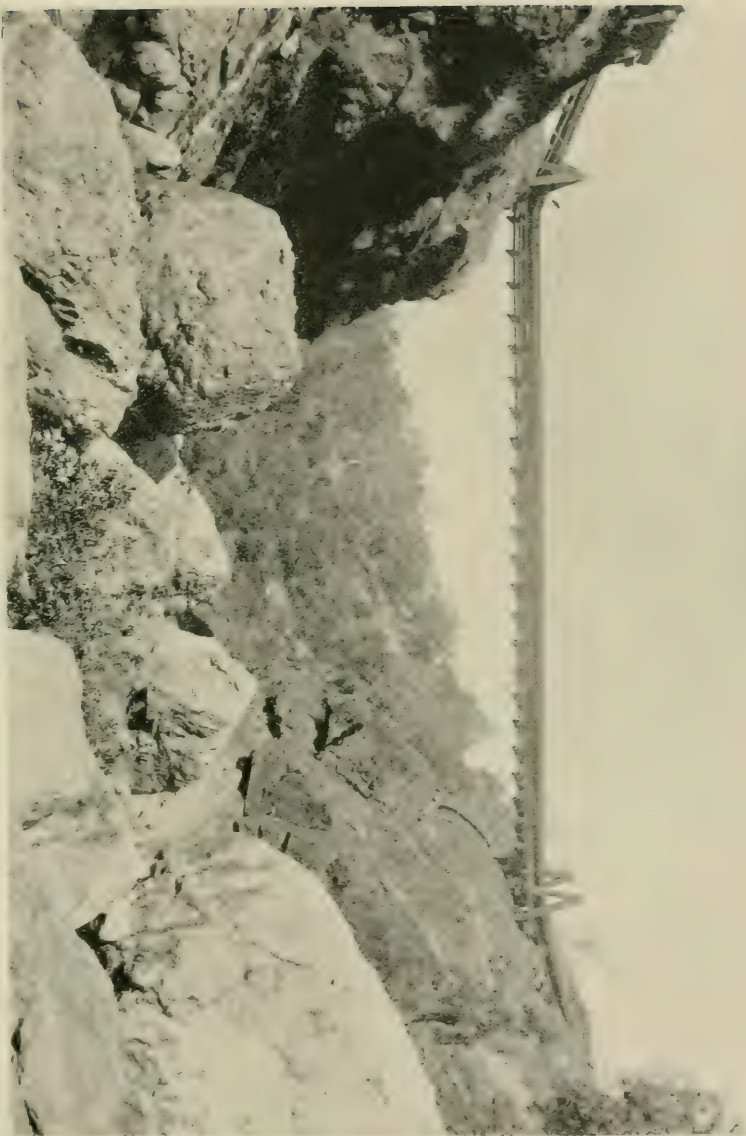
Yolo County is well watered by streams, besides having an abundant supply of subterranean water, which is reached at no great depth. See our Xth Report, p. 773, *et seq.* At present the only permanent mineral industries of the county are brick-making, near Woodland, and the quarrying of building-stone at the Devil's Gate, in Putah Cañon. See our Xth Report, p. 791.

*Cache Creek* (Placer).—Last winter two men were employed for a few weeks in mining on land of F. Scharden. It is said that they made laborer's wages and obtained fine flake gold.

#### YUBA COUNTY.

The entire eastern side of this county presents features extremely favorable to the quartz-mining industry, although little is being done in that direction. We find that at one time several extensive mining operations were carried on around Brown's Valley, and that this district has a record of having produced and shipped at least \$6,000,000, although the deepest working was only 700 ft. beneath the surface. Expensive management, water in mines, and litigation caused the suspension of operations in this once lively camp. From this point N. and E. to the county boundary is a section of country that would well repay an intelligent prospector for his labors; the great drawback being that so much of the land has passed to private ownership through agricultural patents. The entire surface of this section is more or less gold-bearing and ribbed with large quartz veins, which, though largely of a low grade in gold, carry paying shoots, as has been proved in several instances; moreover, numerous seams of quartz make from both sides to these larger quartz bodies, and these are frequently heavy gold-bearers. The formations through this portion of the country are as favorable as any to be found through the mineral belt of California; we find diorites, diabase, metamorphic slates, serpentines, etc. Over large areas of this section at an early day the labors of the placer miner were well repaid, but quartz mining being then in its infancy, the sources of the gold were neglected in the search for the more easily worked placers.

Brown's Valley Irrigation District's 125 ft. Pipe-Line Suspension Bridge, Yuba County.







Under the conditions prevailing at present in the mining world, this section should be taken hold of and made to yield its stores of the precious metal. Wood, water, and transportation present no difficulties, and the fruitfulness of the county secures cheap living.

*Beehive (Mount Hope) Mine (Quartz).*—This is 4 miles E. of Forbestown, in Sec. 8, T. 19 N., R. 7 E. The property comprises 20 acres of mining land and 160 acres of timber land, which is patented. The course of the vein is N. 8° 30' E., and dip 45° E.; the vein averages 4 ft. in width, between a slate hanging-wall and a granite foot-wall. The quartz is of ribbon structure, carrying about 3 per cent of sulphurets, being galena, very large cubical iron sulphides, and fine-grained ones. The mine was worked in former days to a depth of 50 ft. on the vein, and the ground stoped to the surface on a continuous ore shoot of 400 ft. in length. The present owners have sunk on a 30° pitch an incline 70 ft. on the vein, stoping out what was left of the old ground, and are sinking the shaft to connect with an old tunnel which drains the mine. The ore is crushed in an 8-stamp steam mill, with 750 lb. stamps. The ore is passed over grizzly bars 1½ in. apart, then through a Blake crusher to the batteries, old style self-feeders being used, worked by jarring. The stamps drop 96 times per minute, with a 6 in. drop, and about the same discharge at starting; perforated No. 2 tin screens are used, and 2 tons per stamp are crushed daily. Below the mortar is a 4 by 12 ft. apron set on a 1 in. grade to the foot; this narrows down to 1 ft. wide and joins a sluice plate for each battery, 10 ft. long and 1 ft. wide. From the sluice plates the pulp is passed over 35 ft. of blanket sluice, which is washed every hour; it then reaches a riffled sluice, where the riffle is gradually built up by adding inch strips; this box has a grade of 1 in. to the foot. A canvas plant, of seven sections 22 in. wide, with a grade of 1 in. to the foot and 50 ft. long, then receives the pulp, and it finally reaches the slime tanks, 16 ft. long and 12 in. square, set level, with overflow on the upper edge. Some difficulty has been experienced in milling this ore, and the operation is still in the experimental stage. A partial cause of this difficulty is attributable to a large amount of mica carried by the quartz in the upper part of the vein. The machinery is run by steam power, the same set of boilers in the mill building supplying power for both mill and hoist; a 50 horse-power engine runs the mill. Freight from the railroad is 75 cents per 100 lbs. Under the present conditions of milling, cleaning the plates every two or three days and the battery once a month and having no plates inside of the mortar, the proportion of gold saved in the latter is less than on the plates; the gold is worth about \$16 per ounce. Messrs. H. J. Bacon and W. G. Scott, of Forbestown, owners.

*Blue Points Gravel Mine (Placer).*—This is one fourth of a mile E. of Smartsville, adjoining the Excelsior. It has been worked as a drift mine, but the bank caving has closed the entrance, and as hydraulicking is not permitted, the caved mass is being ground-sluiced off. The company obtain their water supply, about 900 in. through 28 miles of ditch, from Wolf Creek. The channel is 2,000 ft. wide, coursing N.W. and S.E., with the north rim very steep. About 25 acres have been worked. Sixty feet of gravel next to the bedrock is cemented, and this has to be worked through an arrastra, after passing through a Gates crusher; the remaining 150 ft. of the bank is freer. The gold is fine and scaly. At

present the company uses 30 sluice-boxes, 4 by 3½ ft., with rock riffles. P. Campbell, of Smartsville, owner.

*Brandy Creek Mine* (Placer).—This is 2½ miles N.W. from Camptonville, and comprises 6,500 by 600 ft. The course of Brandy Creek at this point is N.W. to S.E.; the width of the channel is about 300 ft. This is largely a tailings claim, with occasional patches of virgin gravel on the slate bedrock. The depth of the bank is about 5 ft., while where the gravel is still in place it averages about 1½ ft. in depth. The gravel is free and does not carry many large boulders. The gold is scaly, with some shot gold, and sells for \$18 per ounce. The water season is usually from four to five months. About 300 ft. of the channel has been worked during the past season; about 1½ ft. of the bedrock is picked up. In washing, no boxes are used; there is about 700 ft. of bedrock cut and ground-sluice, in which quicksilver is used, and which is only cleaned up at the end of the season. Messrs. Stevens and others, of Camptonville, owners.

*Chandler Gold Mine* (Quartz).—It is situated 2 miles S. of Brown's Valley P. O., and contains 160 acres of patented ground. The vein courses N. and S., and dips about 45° E., and is 4 in. wide. This is a pocket ledge, as far as proved. J. Lafferty, of Brown's Valley, owner.

*Dakota Mine* (Quartz).—This claim, 1,500 by 600 ft., is 1½ miles N.W. from Brownsville, and is at an elevation of 2,600 feet above sea-level, on a vein running N. 30° W. and dipping 15° E. It is about 3 ft. wide, between rotten slate walls, and carries a very small percentage of iron and copper sulphides. An incline 4 by 5 ft., and timbered throughout, is down 30 ft.; 200 ft. farther to the south, and about 90 ft. lower on the ledge, is a second incline on a 45° pitch on the vein. By digging 2½ miles of ditch, a good water power can be had from the Gordon ditch. Timber is abundant on the ground; freight costs 40 cents per hundred from the Honcut railroad station. Messrs. J. C. Campbell and T. A. Hawley, of Brownsville, owners.

*Dannebrog Mine* (Quartz).—It is in Sec. 16, T. 16 N., R. 5 E., in Brown's Valley, and is a patented claim of 1,500 by 400 ft. The vein courses N. 35° W., in diabase, with a width varying from 2 to 6 ft.; it carries about 3 per cent of sulphurets. Developments consist of an incline on the vein 600 ft. in depth, with six levels, turned every 100 ft. to the east; the maximum extent of the drifting is 300 ft. Three shoots are known, averaging about 140 ft. in length. See our Xth Report, p. 798. — Rideout, of Marysville, and — Burris, of Brown's Valley, owners.

*Delaware Mine* (Quartz).—It is in the immediate vicinity of Indiana Ranch, 6 miles S.E. from Brownsville, and comprises 3,000 by 600 ft. The property is a north extension of the Eagle Mine, the vein coursing N. 28° E., nearly vertical, with decomposed rotten walls; the vein in the upper portion being much decomposed. A shaft has been sunk on the vein 30 ft., and shows 3 ft. of quartz in the bottom, with bunches of iron and copper sulphurets, also free gold of a rusty nature. A tunnel is being run on the vein, which will reach about 5 ft. below the bottom of the shaft, with a length of about 80 ft. The ground has to be timbered throughout on account of slips. No reduction works are here at present, but an arrastra is to be built; water can be had for power from Keystone Creek. Enoch Bros., of Dobbins' Ranch, owners.

*Eagle Gold Mine* (Quartz).—This is near the Indiana Ranch, 6 miles S.E. from Brownsville. The claim consists of 750 by 600 ft. on a large



quartz vein coursing N.E. and S.W., with a slight dip to the S.E. The walls of the vein are entirely decomposed where exposed, forming practically a clay; the country rock is slate and dioritic granite. The old works, consisting of a long tunnel along the vein, is caved in, and the owners at present confine their work to the outcrop. A 5-stamp mill with a portable steam engine stands exposed to the weather. The ore carries some sulphurets, mostly iron. L. Wilder and J. Rodgers, of Dobbins' Ranch, owners.

*Excelsior Water and Mining Company* (Hydraulic).—This claim is situated about one fourth of a mile E. of Smartsville, and extends to Mooney's Flat, with the exception of the Blue Points claim. Under the present conditions governing the workings of such mines, only about 10 acres next to Smartsville can be hydraulicked. A restraining pool for this amount of ground is provided in the old pit and reservoirs from there down to Timbuctoo. The upper settling pool in the former pit has a depth of 75 ft. and a total capacity of 4,000,000 cu. ft. The gravel bank is 150 ft. in height, resting on a cement bottom, on a hard bed-rock. Next to the cement on the rim large bowlders are met, but most of the bank consists of smaller wash. Very little pipe-clay is met, and in only one part of the bank is there any lava capping. The bank is attacked with short drifts, requiring about 200 kegs of black powder per month; besides this from 6 to 8 boxes of Hercules powder are used per month for blasting bowlders. Two "giants" with  $5\frac{1}{2}$  in. nozzles are used; the water, 1,200 in., is delivered through 1,200 ft. of 22 in. and 15 in. pipe, under 200 ft. pressure. The water supply is owned by the company, and is obtained from the South Yuba; a further supply of 1,000 in. is taken from Squirrel Creek.

About 60,000 cu. yds. of gravel are moved per month, which passes through 600 ft. of ground-sluice and 768 ft. of flume, 4 by 3 ft., set on a 5 in. grade, and lined partly with rock riffles and partly with 3 by 4 in. slats. The boxes and the three undercurrents, 6 ft. wide, are supplied with quicksilver. The boxes are cleaned up every two months. The tailings and water pass into the settling pool of the old pit, thence into another pool in the neighborhood of Timbuctoo, and thence down the cañon to the river. The gold is fine and scaly; the largest piece found not exceeding the size of a pea; its fineness is .950. Lewis Conrad, of Smartsville, Superintendent.

*Golden Gate Mine* (Quartz).—This claim, 1,500 by 600 ft., is 4 miles E. of Forbestown. The vein runs E. of N., parallel with the Beehive, and dips E.; the walls are slate and granite,  $2\frac{1}{2}$  ft. apart. Two tunnels have been run for prospecting. S. N. & T. B. Thurston, of Forbestown, owners.

*Golden Mary Mine* (Quartz).—This claim, 1,500 by 600 ft., is 1 mile S W. of Brownsville, in Sec. 34, T. 19 N., R. 6 E. The vein varies from 3 to 6 ft. wide, courses a little E. of N., and dips  $57^{\circ}$  W.; the walls are soft and decomposed as far as the work has proceeded. The country rock is partly slate and partly a dioritic granite. The quartz is white, milky, somewhat brittle, and with ribbon structure, and carries a small percentage of iron and copper sulphides; free gold is also visible at times. There are several heavy quartz outcrops lying parallel, and apparently all dipping to the west. It is on the most westerly of these that the prospect work is being done, which consists of an incline shaft  $4\frac{1}{2}$  by 8 ft., sunk to a depth of 28 ft. on the vein, showing a 6 ft. vein in the bottom;

the ore shoots, as far as can be ascertained, pitch to the north. About 100 ft. from the shaft is a 10 ft. arrastra, run by a 16 ft. overshot wheel, requiring 40 in. of water, which is taken from the Forbestown ditch at a cost of 10 cents per inch. Timber can be had for the cutting; lagging costs 3 cents apiece. Freight is brought from Honcut at 40 cents per hundred. H. L. Clark and T. Cobain, of Brownsville, owners.

*Good Hope Gold Mine* (Quartz).—This claim, 3,000 by 600 ft., is three fourths of a mile from Cabbage Patch, 10 miles E. of Wheatland. The vein, which is only a few inches wide on the surface, courses N.W. and S.E., dips about 70° S.W., and is inclosed between diorite and slate walls. The quartz carries both free gold and  $4\frac{3}{4}$  per cent iron, copper, and zinc sulphurets. The developments consist of a shaft (4 by 6 ft.) sunk on the vein 190 ft., and a drift 90 ft. long. In the bottom the vein is 16 in. wide, and 70 ft. of an ore shoot has been cut, pitching S.E.; the end of the shoot has not yet been reached. The ore is hauled 3,000 ft. to a 4-stamp steam mill at a cost of 25 cents per ton. The mine requires but little timbering, and up to date no artificial ventilation. The timbers are obtained on the ground for the cutting. The 4-stamp mill has 300 lb. stamps and an apron 6 by  $12\frac{1}{2}$  ft., but no concentrators. If the contemplated extension of the South Yuba ditch is carried out, over 100 ft. of water pressure can be obtained at the mine. The hoisting is done at present by horse-whim. R. Vincent et al., of Grass Valley, owners.

*Hibbert & Burris Mine* (Quartz).—This claim, 1,500 by 600 ft., is one fourth of a mile N.W. from Brown's Valley, in Sec. 16, T. 16 N., R. 5 E. The vein courses E. and W., dips about 40° N., and has a width from 6 in. to 4 ft., inclosed in diorite, with a good gouge. Developments consist of an incline shaft on the vein 170 ft. deep, and two levels turned west 180 ft., at 90 ft. and 140 ft. A block of ground about 100 ft. in length has been stoped to the surface. Two ore shoots are known; one has been cut and the tunnel is being driven ahead to cut the second about 250 ft. distant; these shoots trend to the east. Very little timbering is required in the mine, and a 4 in. pump, running twelve hours, holds the water. The ore carries  $12\frac{1}{2}$  per cent of iron and copper sulphides. A 5-stamp steam mill, 800 lb. stamps, reduces the ore, making 90 drops per minute, using iron shoes and dies, and giving a duty of 2 tons per stamp in twenty-four hours; the mill runs only on the day shift; rock-breaking and feeding are done by hand. The mortar is supplied with front and back inside plates; No. 40 brass wire screens are used, and the stamps have a 6 in. drop and discharge. The water is partly supplied on the outside; the lip of the mortar is covered with plate; the apron is 6 ft. long and set on a grade of 1 in. to the foot; below the aprons, following the drop-box, are two parallel sluice plates 6 ft. long by 20 in. wide; from these the pulp passes over four sections of canvas table; but few sulphurets are saved. The power is derived from a 20 horse-power engine, with a 36 in. by 12 ft. boiler. The pump is a 4 in. jackhead. It requires one cord of wood per shift to run the machinery, costing \$3 per cord. Timbers cost from 2 to 7 cents per running foot, and lagging 5 cents apiece. The bullion yield is 50 per cent from battery; the balance from plates, which are scraped every day; the battery is cleaned up twice a month. Gold is .763 fine. Wages are \$2 50 for miners and \$3 for mill men. See our Xth Report, p. 789. Messrs. Hibbert & Burris, of Brown's Valley, owners.

*Honeycomb Gold Mine* (Quartz).—This is  $1\frac{3}{4}$  miles W. from Camptonville, on the west side of Willow Creek, and contains twelve claims. There are five veins in the property, running nearly parallel, with some cross-veins, the general course being N.  $50^{\circ}$  E., with a dip of  $80^{\circ}$  S.W. Some of the veins are in slate, others in granite, and vary in width from one foot upward. Several tunnels have been run and a little stoping done near the surface, showing the ore to carry considerable limonite. That known as the Honeycomb vein proper has a strike of N.  $25^{\circ}$  W., in granite rock, with a width of fissure of 4 ft. on the surface, while in the bottom of a 90 ft. shaft it shows only 8 in. of quartz. A deep tunnel, 500 ft. below the croppings, is being run to cut these veins, and is now 200 ft. long; it is being carried near the contact of the slate and granite. H. Malloch, of Marysville, Secretary.

*Jefferson Gold Mine* (Quartz).—This is immediately south of Brown's Valley; it is owned by an incorporated company, claiming 1,500 by 400 ft. The vein courses N.  $10^{\circ}$  W., dips  $45^{\circ}$  E., and has a width of 13 to 18 ft., in diabase and slate casings. The ore shoot is 300 ft. long, pitching  $35^{\circ}$  N. The mine has been opened by an incline 800 ft. deep, with a drift running N. 300 ft.; in the bottom there is a 13 ft. ledge. G. Harney, of Marysville, Secretary.

*Johnson Gold Mine* (Quartz).—This claim, 1,000 by 600 ft., is 3 miles W. of Brownsville, in Sec. 28, T. 19 N., R. 6 E. The vein courses E. and W. and dips  $45^{\circ}$  N. The country rock is slate and diorite; the vein is about 6 ft. wide, and carries about 2 per cent of sulphurets. An incline shaft has been sunk on the vein 80 ft., and a drift run to the E. about 75 ft. and W. about 20 ft.; some stoping has been done near the surface. A 5-stamp mill, as well as the hoist and a pump, are run by Pelton wheels under 130 ft. pressure; the water, 60 in., is furnished from the Forbestown ditch for \$4 per day. The stamps weigh 750 lbs. each. Beyond the mill is a canvas plant, but no concentrators. H. A. Conwell, of Brownsville, owner.

*Mosquito Mine* (Placer).—This is on Indiana Ranch, 6 miles S.E. from Brownsville, and comprises 80 acres. The bank is about 6 ft. deep, with 4 ft. of soil capping; the bedrock is decomposed. A bedrock cut, 60 ft. long, is used for saving the gold; no boxes are used. The water is brought from Red River to the mine through one fourth of a mile of ditch and 700 ft. of 6 in. pipe; the water season lasts six months. The gravel carries coarse gold, and most of it on and near the bedrock. The clean-up is made at the end of the season. The gold sells for \$18 25 per ounce. C. E. Morey, of Dobbins' Ranch, owner.

*Mount Hope Mine* (Quartz).—See Beehive Mine.

*Old Pittsburg Claim* (Drift).—This is 7 miles N.W. of Camptonville, and comprises 18 acres of ground on a channel that has been worked on both sides of the present claim, though never completely bottomed. The course of the channel is E. and W., with a width of 300 ft.; the old works extended for about 400 ft. on the channel. The gravel is dark and carries about 60 per cent of cobbles and bowlders, on a granite bedrock; it is picking ground and carries coarse gold, selling for \$18 50 per ounce. A bedrock tunnel 370 ft. long has been run N.  $15^{\circ}$  W. from the cañon. A car, carrying 1,500 lbs., is used, but no gravel has been breasted out yet. The water, 50 in., is obtained from a branch of Lost Creek, and conveyed through three fourths of a mile of ditch, being delivered at the mouth of the tunnel under a pressure of 50 ft. Thirty



boxes are used on an 8 in. grade; these are supplied with Hungarian riffles. The company obtain their timber on the ground, their lagging costing 3 cents apiece. This channel is lava capped, carrying about 7 ft. of pay gravel, the 6 in. next the bedrock being the richest part. F. W. Haley et al., of Camptonville, owners.

*Rattlesnake Gold Mine* (Quartz).—This is one mile N. of Brown's Valley. The vein courses E. and W., dipping 40° N., in diorite; it is 18 in. wide. Cabalier & Co., of Brown's Valley, owners.

*R. C. Mine* (Quartz).—This claim, 1,500 by 600 ft., is one fourth of a mile E. of Brownsville. The vein, 18 in. to 4 ft. wide, courses N. and S., dips 45° E., and has walls of chloritic slate and diorite. The mine is being worked at present through two tunnels 100 ft. apart perpendicularly, and are 700 and 800 ft. long. The lower tunnel, which starts near the level of Dry Creek, is connected with an incline raised out near the mill. Through this the ore will be hoisted to the mill, while the water is run out from the tunnel. The 10-stamp mill is run by a Pelton wheel on the creek; the power being transmitted 750 ft. by wire rope. The mill contains a Dodge rockbreaker, grizzlies, Hendy self-feeders, two Frue and one Woodbury concentrator, and a small canvas plant. Reub. Clark, of Monticello, owner.

*Slag Gold Mine* (Quartz).—It is three fourths of a mile N. of Brown's Valley, and contains 1,500 by 400 ft. The vein courses N. and S., dips 50° W., and has an 8 in. vein in diorite. It was opened by a 200 ft. shaft sunk on the vein. Thomas Gotman, of Brown's Valley, owner.

*Sweet Vengeance Gold Mine* (Quartz).—It is 1½ miles N. of Brown's Valley, and claims by patent 3,000 by 400 ft. It is owned by an incorporated French company, having an office in San Francisco. The vein courses N. and S., dips E., between walls of diorite, about 3 ft. apart.

*Templar No. 3 Mine* (Quartz).—This claim, 1,500 by 600 ft., is half a mile E. of Indiana Ranch. The vein courses N.E. and S.W., and dips about 12° E., in a granitic formation, showing an average width of 2 ft. The sulphurets have been saved, but not worked. The vein has been worked through a cross-cut tunnel about 50 ft. below the surface; the block from tunnel to surface having been stoped out. The drift is timbered throughout. The steam-power mill has two 800 lb. stamps. No. 40 punched screens, and plates 2 by 14 ft., leading to two Frue concentrators. The tailings have all been restrained, but never worked. Cordwood costs \$1 50; the mill uses 3 cords per day. Joe Merriam, of Dobbins' Ranch, owner.

*York Mining Company* (Hydraulic).—This is on New York House Flat, 1½ miles W. of Challenge. It contains 190 acres; 50 acres on the flat, of which from 6 to 8 acres have been worked. The bank, which is 15 ft. deep, has 6 in. of gravel on the soft granite bedrock, covered by 3 ft. of clay, the remainder being soil capping. The course of the gravel is N. and S., with a grade of 4 in. to the rod. The flume is half a mile long, lined with block riffles. The water season lasts three months, using the natural drainage from the surrounding country, which is brought through 700 ft. of 7 in. pipe under 60 ft. pressure, and discharged through a 2 in. nozzle. Lumber is worth \$12 50 per thousand feet. Wages are \$2 50 per day. The mine is worked by the owners. H. A. Conwell, J. W. Albert, and James Elliott, of Brownsville, owners.

## GYPSUM.

It has been ably demonstrated by Prof. E. W. Hilgard, of the University of California, that this mineral is indispensable in reclaiming lands which are rendered unproductive by the presence of sodium carbonate, which is the most deleterious constituent of "black alkali." Fortunately, there is an abundance of gypsum in the Coast Range.

## FRESNO COUNTY.

*Coalinga Mine.*—This is owned by the Coalinga Gypsum and Fertilizing Company, of Fresno, D. A. Overal, Secretary, and is situated about 9 miles N. of Coalinga, at which village a mill for grinding the gypsum has been erected. The workings at this mine consist of two open cuts. At one of these cuts the stratum mined is about 10 ft. in thickness. At the other open cut, which is probably 100 yds. south of and 25 ft. below the cut already described, there are two distinct strata, from which gypsum is obtained. It is said that about 500 tons of material have been taken from these mines, and that it finds ready sale as land-plaster in Tulare and Fresno counties.

*Paoli Mine.*—This mine was examined by Professor Hilgard, who has been kind enough to supply the following information: "It is located in the ridge bordering the west side of the Great Valley, just north of Tome Creek, and about 5 miles south of the Big Panoche. It was discovered in 1892 by J. H. Hall, of Selma, and is owned and worked by the Paoli Gypsum Company, of Selma and Mendota, Fresno County, the location being about 18 miles S.W. from the latter station. The main ridge on which the gypsum appears at the highest level, extends about 300 ft. along the creek, to which it falls off steeply. Toward the north there extends from this ridge four spurs, from one third of a mile to one mile long, on the crests of which the gypsum crops out abundantly, with a gentle dip toward the valley. The deposit on the crest of the main ridge, where most work has been done, shows a thickness of at least 30 ft., but its lower limit has not been exposed. At the foot of the east slope of the third spur from the main summit, in a deep cañon, and 150 ft. vertically below the highest outcrop, there is a long exposure of a regular stratum about 18 ft. thick. Whether or not there exists a solid mass of the mineral from the outcrop to the summit, cannot be seen; should such be the case the mass would be enormous, but in any case the deposit is a very large one, sufficient to supply the needs of the San Joaquin Valley for a long time to come.

"The samples collected, which of course are essentially croppings, show the material to be very nearly uniform from top to bottom; a yellowish-white chalky mass, easily crumbled and therefore readily put in shape for farmer's use. Eight samples were selected to represent the outcrops on the crests of the several ridges and also the one in the cañon mentioned above. The analysis of four of these gave the following results:

	Gypsum.	Clay.	Sand, Moisture, and Carbonate of Lime, etc.
No. 1, from summit of main ridge.....	95.24	1.98	2.78
No. 5, from second spur middle of crest.....	94.74	1.52	3.74
No. 6, from third spur in cañon.....	92.90	2.60	4.50
No. 7, from fourth spur near road.....	82.20	8.21	9.59

"These results render superfluous the analysis of the other four samples taken. It is probable that had the sample No. 7 been taken farther from surface, most of the sand it contained would not have been found, since the rest contain none like it. Probably the average of the whole deposit ranges above 90 per cent, since the only one of the samples taken in the mass itself (No. 1, from the main workings thus far done) is the highest of all, and, counting out the 2 per cent or thereabouts of atmospheric moisture, is probably equal in purity to any gypsum thus far found in quantity west of the Sierra Nevada. Selected portions of the deposit will undoubtedly be available for burning into plaster of Paris for builders' use."

## KERN COUNTY.

There are extensive deposits of impure gypsum in the foothills on both sides of the San Joaquin Valley, in Kern County. On the western side of the valley the principal deposits are situated in the S.E. borders of the Sunset Oil District. It occurs in a stratum of soft, chalky-looking rock, which in some places attains a thickness of several feet. A sample of this material, which was examined in the laboratory of the Mining Bureau, showed:

	Per Cent.
Gypsum .....	86.07
Calcium carbonate .....	11.07
Iron and alumina estimated as $\text{Fe}_2\text{O}_3$ and $\text{Al}_2\text{O}_3$ .....	.50
Residue insoluble in acid .....	2.50

Another contained only 70 per cent of gypsum. It is said that other samples from this district have been found to contain less than 63 per cent of gypsum. The deposits of gypsum on the eastern side of the valley are found in the foothills of the Sierra, and present a similar appearance to the deposits of gypsum in the Sunset Oil District.

## LOS ANGELES COUNTY.

*Alpine Plaster Company of Los Angeles.*—The gypsum mine owned by this company is situated in Antelope Valley, in the northern part of the county, distant about half a mile from Palmdale, on the S. P. R. R. The gypsum occurs as a superficial stratum about 25 ft. in thickness, and covers an area of about 25 acres; it is mined by surface workings, 2 men being employed. It is shipped to Los Angeles, where it is ground in a mill belonging to the company; 5 men are employed in this mill. The plant consists of one steam plaster mill having a capacity of 10 tons per twenty-four hours. The products of the mill are as follows:

Name of Substance.	Average Monthly Sales 1893-94.	Price f. o. b. Cars at Los Angeles in Carload Lots.
Plaster of Paris .....	15 tons.	\$18 a ton.
Wall-plaster .....	20 tons.	11 a ton.
Fertilizer (land-plaster) .....	100 tons.	7 a ton.



## RIVERSIDE COUNTY.

*Banning.*—The California Portland Cement Company, of Los Angeles, have commenced to manufacture plaster of Paris from a gypsum deposit near Banning. The works are at Colton, where the cement works are also located.

## SAN LUIS OBISPO COUNTY.

*On Alamo Creek.*—Gypsum is found on Alamo Creek, 16 miles from Santa Maria. Beds of gypsum are scattered over an area of 40 acres; some of them are white and some gray. They occur in irregular veins like that at Point Sal, and in a similar formation. Developments consist of short tunnels and open cuts.

## SANTA BARBARA COUNTY.

*Owen Gypsum Company.*—The vein of gypsum is on the east side of Santa Barbara Cañon, on the northern slope of the Cuyama range. It is of good quality, some of it being almost as clear as alabaster and faintly mottled, and is capable of taking a good polish. The outcrop is much broken, and the development does not yet show whether it is present in quantity sufficient to pay for working. The distance from market would be one great drawback. The bed is inclosed in Tertiary clays, which in this region, and particularly on the north side of the Cuyama River, are generally impregnated with gypsum in the form of selenite.

*Point Sal Gypsum Mines.*—These mines are idle at present, owing, it is said, to the cheapness with which the gypsum can be obtained in other places. Point Sal consists of an axis of crystalline rocks, on which rest the Tertiary clays and sandstones, dipping away in various directions. The bunchy gypsum veins are found in the clays. They are not well exposed at present, as all the old workings have caved in. See our VIIIth Report, p. 538, and Xth Report, p. 601.

## IRON.

While iron ores have been found in many of the counties of the State, and in several instances in extensive deposits, lack of suitable cheap fuel has generally prevented their being utilized. Some years ago an extensive plant was put up in Placer County, where charcoal was used for fuel, but upon the destruction of the furnaces, etc., by a fire, operations ceased. A few hundred tons of iron ore from Shasta County were used by local rolling mills and foundries in 1893, but aside from this there was no production.

## AMADOR COUNTY.

*Ione Coal and Iron Company.*—A thin bed of bog iron occurs in the Cretaceous hills at and north of Carbondale. The largest outcrop is about 18 in., and as it contains a large amount of silica it is worthless.

## HUMBOLDT COUNTY.

*Centerville.*—In the gray metamorphic sandstones on the beach, 4 miles S. of Centerville, occur veins of hematite. One of them, exposed by the action of the surf, is 8 ft. thick. Thin seams of calcite make up one fourth of the mass. The strike is E. and W. at right angles to the coast-line, and the dip is  $85^{\circ}$  N. The ore is soft, of brown-red color, and has a tendency to become scaly like micaceous iron. The second vein is represented by boulders of ore lying on the beach about 1 mile N. of the other. The cropping is covered up by a landslide. The float shows a better quality of ore, free from visible calcite. The third vein occurs about half a mile S. of the first one, and the cropping is also covered up. Large masses of ore in the mouth of a little gulch are the only evidences of its existence. Some of it is ground and used as mineral paint in the vicinity, for which it seems well adapted.

*Preston Iron Mine.*—On James Creek, 2 miles N.E. of Arcata, some prospecting has been done for iron. The rocks in this vicinity are decomposed serpentines and highly metamorphosed sandstones, containing iron and quartz. The soil, covering the hills from 6 to 15 ft. deep, is stained red with iron. The prospect work consists of a hole 4 ft. in diameter and 20 ft. deep, and a crooked tunnel 45 ft. in length, to meet it at the bottom. The shaft for the greater part of its depth is undoubtedly in ore, but the tunnel shows none at all. The strata dip  $65^{\circ}$  N.E. and the tunnel runs in S.W., so that should a regular vein exist, the tunnel would cut it at a point between 20 and 40 ft. from the mouth. It is possible that the ore found in the shaft has slid down the hill in a body—slides being frequent here—and that a vein exists higher up the hillside. The quality of the ore seems fair—a soft red hematite—but whether it exists in sufficient quantities to make the deposit of commercial value has yet to be demonstrated. Another opening has been made in the next gulch south, but no considerable body of iron found, the quartzose sandstone being merely stained by iron and manganese.

## INYO COUNTY.

*Argus Range, East Slope of.*—About 5 miles S. of the mouth of Shepard's Cañon, and almost on the edge of Panamint Valley, is a considerable body of hematite iron, seemingly of excellent quality. It lies near the contact of limestone and granite. The iron appears in the form of bunches of varying size over an area several hundred feet in diameter. It is said to carry a trace of gold. It was used as a flux years ago in the Lookout smelter. Nothing but surface work has been done, so that its downward extent is not known.

*Mountain Spring Cañon.*—On the south side of Mountain Spring Cañon, near its head, is a ledge of hematite iron running E. and W. The float is very abundant, but the croppings are mostly covered, so that the extent is not known. It is inclosed in granite.

*Shepard's Cañon.*—A vein-like deposit of hematite outcrops in Shepard's Cañon, in the Argus range. It occurs in mica schist near the contact with granite. The deposit is apparently not very extensive.

## LOS ANGELES COUNTY.

*Mount Gleason Deposits.*—On the south slope of Mount Gleason, near the head of Little Tejunga Cañon, is the Padre claim. At the western base, half a mile from Ravenna Station, good magnetic iron ore is found. None of the deposits appear to be very extensive, but in each the ore is of good grade.

## SAN BERNARDINO COUNTY.

*West Lava Beds District.*—About 26 miles S.E. of Daggett, in this district, are large deposits of hematite and magnetite of superior quality. It has been proposed several times to open these deposits for the purpose of manufacturing iron, but never undertaken. The main shaft of the cruiser "Monterey" was made from ore taken from these mines. See our IXth and XIth Reports, pp. 235 and 349. Neeley et al., of San Diego, owners.

## NAPA COUNTY.

*Iron Mine Company.*—Their property is situated at the head of Sulphur Creek, and comprises 400 acres on a range coursing N. and S., composed largely of green and red jaspery rock, through which veins of hematite course in an E. and W. direction. Some surface openings have been made, showing a  $3\frac{1}{2}$  ft. vein.

*Clay Iron Ore.*—It is found on the N.E. slope of the mountain flanking Conn Valley. No mining has been done here.

## SHASTA COUNTY.

*Lost Confidence Company's Mine.*—A body of hematite, covering about 40 acres, is situated near Slick Rock Creek, running parallel with the silver ore outcrop. It is very pure and could be delivered on the cars at the bank of Sacramento River through an inclined tramway at a small expense.

*Maxwell Mine.*—This is  $1\frac{3}{4}$  miles E. of the United States fishery, and comprises five claims. The ore body lies in limestone and is extensive, containing largely magnetic iron; it has a general E. and W. course.

*Potter Mine.*—This is  $1\frac{1}{2}$  miles E. of the United States fishery, on McCloud River, and comprises three claims. The ore body runs E. and W., in a large limestone belt, and carries principally magnetic iron with some limonite and brown iron ores. Analyses are said to show a trace of phosphorus but no sulphur, except near the river, a little silica, and an average of 70 per cent iron.

## SONOMA COUNTY.

*Fisk's Mill.*—Three miles inland, on the Lancaster ranch, a body of iron ore has been slightly exploited, which is a part of an ore body running W. and S. along the coast for miles.

*Fort Ross.*—Six miles E. of Fort Ross is a body of iron ore, mostly hematite, coursing N., of considerable extent.

*Nobles.*—Five miles N. of Mr. Noble's ranch, near the West Fork of Gualala River, is a large body of hematite and silicate of iron.



## MAGNESITE.

This mineral occurs in large deposits at several places in California, though it is not abundant elsewhere in the United States. The entire domestic production is from this State, though but one of the many known deposits is worked—that at Childs Valley, Napa County. Nearly all the raw ore is used locally by the Pacific Rolling Mills for furnace linings. Did freight rates permit, a good market for the ore could be found in Pittsburg, Pa., which now uses imported ore for furnace linings. The calcined ore made at the Snowflake Mine, Childs Valley, is utilized in the manufacture of paper from wood pulp, in which it is used as a bleaching agent. Some little of the raw ore has been here used experimentally in the manufacture of artificial stone, paint, Epsom salts, flocculent magnesia, and in other chemical processes. It takes about two tons of raw to make one of calcined ore.

## NAPA COUNTY.

*Berthenia Mine.*—This property, 1,500 by 600 ft., is in Soda Valley, 12 miles E. of Rutherford, in Sec. 25, T. 8 N., R. 4 W. The fissure strikes N. 40° W. and dips E. 55°, carrying 3 ft. of a fine quality of magnesite. The croppings can be traced for several miles. Only surface work has been done. C. D. Mooney and S. H. Delmater, of Chile, owners.

*Snowflake Mine.*—It is in Childs Valley, adjoining the Phelan ranch, and about 2½ miles in an air line from the Berthenia, comprising 40 acres, apparently on the same fissure, as the strike and dip are practically the same as the Berthenia. The main fissure is 5 ft. wide, but near the surface, especially on the foot-wall side, the soil for many feet is filled with nodules of magnesite, cemented together in part by iron sinter. There have been 3,000 tons extracted, and about 150 tons are at present on the dump. A furnace to calcine 5 tons per day is on the ground. The main works are about 150 ft. above the valley road. Usually 10 men are employed. About 40 tons of magnesite has been manufactured into Epsom salts and flocculent magnesia by the Golden City Chemical Works, of San Francisco. W. H. Whitton et al., of St. Helena, owners.

Another magnesite deposit, about 1 mile S., has been discovered, but no work has been done. This mine is called the Cleveland.

## SANTA CLARA COUNTY.

Magnesite occurs in this county in numerous places, but none of the deposits are at present being worked, and but few of them are opened at all. The *Jarvis* and *Mammoth* magnesite claims, situated on the Cerro Colorado, or Red Mountain, have been described in our XIth Report, p. 374. Neither of these properties have been worked since the last report.

On the ranch of M. H. Hyland, 9 miles S.E. of San José, there are croppings of magnesite, which are 10 to 15 ft. wide and 300 ft. in length. No development work has been done on the deposit.

On the property of the *North Almaden Mining Company*, near the place above, are croppings of magnesite.

The mineral occurs in small bunches in many places in the serpentine, in various parts of the county.

## MANGANESE.

## ALAMEDA COUNTY.

*Bartlett Mine.*—It is in Mitchell Cañon. See our IXth Report, p. 121. It was idle the past two years. There are "prospects" in Mitchell Cañon, near Corral Hollow, that are not developed.

*Estacio Mine.*—It is on the ranch of Belcher F. Estacio, 8 miles S.E. of Livermore, on the Cedar Mountain road. This is a new prospect, and very little work has been done and no ore shipped. A small cut exposes a mineral body 8 ft. wide, in which occurs some good and a great deal of poor manganese ore. About 100 yds. W. croppings 6 to 8 ft. wide are again seen, but nothing has been done at this latter place. The owners are making preparations to open their property during the summer of 1894.

*Mendenhall Mine.*—This is half a mile S. of the Cedar Mountain road, and 11 miles S.E. of Livermore; it is not working. In 1893 this mine produced 120 tons of good ore. The vein becoming very narrow, work was suspended and has not been resumed.

*Merchant Mine.*—This is 11 miles S.E. of Livermore, in Sec. 21, T. 4 S., R. 3 E., M. D. M. This deposit was discovered quite recently. Four men are employed. There are several deposits in the vicinity, only two of which are opened and worked. The one making the best showing strikes E. and W., and is about 1 ft. in width. The ore is clean and high grade. The mine has produced, up to April 1, 1894, about 60 tons of fine ore, and the owner feels confident of securing at least 100 tons more. The product of this mine is bought by Messrs. Taylor & Pitcher at Livermore. These gentlemen contemplate the erection of a plant to grind and cleanse manganese ore, in which they deal quite extensively.

*Taylor & Pitcher Mine.*—This is in Corral Hollow. In 1893 it produced 150 tons of ore. The mine was shut down in the latter part of that year, and has not been operated since. The mine has produced, in all, 300 tons.

## MARIN COUNTY.

On the *Mailliard Ranch*, about  $7\frac{1}{2}$  miles W. of San Rafael, is a deposit of black oxide of manganese. The ores are chiefly pyrolusite and psilomelane. The deposit was opened superficially years ago, but of late nothing has been done with it. The owner was negotiating with dealers in the spring of 1894, and was considering the advisability of opening the deposit. It is  $1\frac{1}{2}$  miles from the railroad station at San Geronimo. A good wagon road passes within a short distance of the deposit, which, from surface indications, is quite extensive.

Manganese also occurs on the hillside near Sausalito, but it has not been worked in a very long time.

## NAPA COUNTY.

*Manganese Deposit.*—It is on the N.E. side of Conn Valley, cropping out about 200 yds., and nearly 60 yds. wide.

## SAN BENITO COUNTY.

*Cleveland Manganese Mine.*—This is a deposit recently discovered. It is located just over the summit on the eastern slope of the Coast Range, 20 miles E. of Tres Pinos, and about 3 miles E. of the Los Muertos ranch. Red jasper occurs, impregnated with manganese, over an area of 100 ft. in diameter. On one side of this area the manganese is found almost wholly replacing the jasper in an irregular vein, from 2 to 4 ft. in thickness. But little work has been done and the extent of the deposit is not determinable.

## SAN LUIS OBISPO COUNTY.

A half mile S.E. of the Profumo iron deposit, and about 4 miles W. of San Luis Obispo, is a small outcrop of manganese. It occurs impregnating a stratum of jasper, which is probably a continuation of that containing the iron. In a portion of the deposit the manganese is of a very high grade.

## SANTA CLARA COUNTY.

On *Penitencia Creek*, about 3 miles above Alum Rock, is a huge bowlder of manganese. It lies on a low terrace near the creek, and was at one time supposed to be the cropping of a large vein, for which an enterprising citizen of San José paid dearly. The main ledge from which it came is supposed to be one of those near the head of the creek, about due north from Mount Hamilton. In that vicinity there are several deposits of manganese of good quality, but nothing has been done on them for years.

A deposit of manganese occurs on the ranch of *R. Foville*, which is described in our XIth Report, p. 374. Nothing has been done with this deposit.

## SONOMA COUNTY.

*Shaw's Mine.*—Situated 7 miles N.W. from Cloverdale is a body of very pure manganese ore (60 to 80 per cent) cropping out about 10 ft. wide, between slate and limestone, with a N.W. course. Open cuts have been made on the croppings and 50 tons of good ore are on the dump; none has been shipped and the mine is not worked. J. E. Shaw, of Cloverdale, owner.



## MINERAL SPRINGS.

## ALAMEDA COUNTY.

*Piedmont White Sulphur.*—They are about 3 miles from Oakland, and have gained considerable local reputation as medicinal waters. Analyses by Winslow Anderson, M.D.:

	Iron Spring.	White Sulphur.
	Grains per U. S. Gal.	Grains per U. S. Gal.
Sodium chloride.....	5.10	7.91
Sodium bicarbonate.....	11.70	9.40
Sodium carbonate.....	.52	6.20
Potassium carbonate.....	3.15	.76
Potassium iodide.....	Trace.	Trace.
Magnesium carbonate.....	6.37	3.17
Magnesium sulphate.....	1.03	17.80
Calcium carbonate.....	2.13	3.32
Calcium sulphate.....	1.60	7.09
Ferrous carbonate.....	1.73	Trace.
Alumina.....	.45	Trace.
Borates.....	5.23	1.90
Silicates.....	4.19	5.06
Organic matter.....	Trace.	Trace.
Total solids.....	43.20	62.61
Carbonic acid gas.....	7.25 cu. in.	4.60 cu. in.
Sulphuretted hydrogen.....	Trace.	9.25 cu. in.

## COLUSA COUNTY.

*Clark's.*—See our Xth Report, p. 159.

*Simon's Hot Sulphur.*—They are located in Sulphur Cañon, near Wilbur Springs. The waters have a temperature of 170° F. and are highly charged with sulphuretted hydrogen.

*Wilbur Springs.*—They are 30 miles from Colusa, and are pleasantly situated and have acquired considerable reputation from their therapeutic properties. The resort is reached by railroad to Williams and thence by stage. Analysis by Winslow Anderson, M.D.:

	Grains per U. S. Gallon.
Sodium chloride.....	19.75
Sodium carbonate.....	3.40
Sodium sulphate.....	26.19
Potassium chloride.....	.46
Potassium iodide.....	.75
Magnesium carbonate.....	5.10
Magnesium sulphate.....	22.90
Calcium carbonate.....	8.44
Calcium sulphate.....	20.62
Ferrous sulphate.....	4.16
Alumina.....	3.93
Silicates.....	6.95
Organic matter.....	1.74
Total solids.....	124.39
Sulphuretted hydrogen.....	43.97 cu. in.

## CONTRA COSTA COUNTY.

*Byron Springs.*—These famous springs are pleasantly situated near the foothills in the spur of the Coast Range Mountains, about 16 miles S.E. of Mount Diablo, and about 1½ miles from Byron Station. The

springs lie in a small valley leading from the San Joaquin plains. The surrounding hills are composed of calcareous shales. The valley is covered with adobe clay and fine white sand, through which the springs bubble. They are among the many natural wonders in our State, and being only three hours' ride from San Francisco, are much visited by tourists.

Dr. Winslow Anderson, who has made the following analyses, states that there are more than fifty springs or outlets from the subterranean passages; some are cold and others are hot, ranging from 50° to 140° F. Within a few feet of each other there will be a cold carbonate spring and a hot sulphuretted spring. The cold soda springs come from the surface water, but the hot water (sulphuretted) must come from a considerable distance down in the earth's crust.

*"Liver and Kidney Spring."*

	Grains per U. S. Gallon.
Sodium chloride .....	622.07
Potassium chloride .....	33.74
Potassium iodide .....	.79
Potassium bromide .....	Trace.
Magnesium chloride .....	3.92
Magnesium carbonate .....	15.75
Calcium chloride .....	85.37
Calcium sulphate .....	1.12
Calcium carbonate .....	.59
Barium carbonate .....	.93
Ferrous carbonate .....	.72
Ammonium chloride .....	3.05
Silica .....	1.00
Organic matter .....	Trace.
Total solids .....	769.05
Free carbonic acid gas .....	7.82 cu. in.

*White Sulphur Spring.*

	Grains per U. S. Gallon.
Temperature, 76° F.	
Sodium chloride .....	12.01
Sodium bicarbonate .....	12.94
Sodium sulphate .....	1.34
Potassium chloride .....	Trace.
Potassium carbonate .....	2.37
Potassium sulphate .....	Trace.
Magnesium chloride .....	Trace.
Magnesium carbonate .....	2.50
Calcium carbonate .....	1.13
Ferrous carbonate .....	3.00
Silica .....	.26
Organic matter .....	Trace.
Total solids .....	36.06
Carbonic acid gas .....	21.17 cu. in.
Sulphuretted hydrogen .....	5.80 cu. in.

EL DORADO COUNTY.

*Glen Alpine.*—They are in a wild rugged gorge, 7 miles from Lake Tahoe, altitude 6,700 ft. The gorge is filled throughout its entire length with varied scenes of beauty and grandeur, and terminates abruptly in a glacial amphitheater. Analysis by Winslow Anderson, M.D.:

*Carbonated and Chalybeate.*

	Grains per U. S. Gallon.
Sodium chloride.....	21.17
Sodium carbonate.....	32.75
Potassium carbonate.....	Trace.
Magnesium carbonate.....	9.96
Calcium carbonate.....	45.09
Calcium sulphate.....	4.10
Ferrous carbonate.....	1.80
Alumina.....	1.43
Borates.....	Trace.
Silica.....	2.50
Organic matter.....	Trace.
Total solids.....	118.80
Free carbonic acid gas.....	138.36 cu. in.

## FRESNO COUNTY.

*Fresno Hot Springs.*—See our Xth Report, p. 189.

## HUMBOLDT COUNTY.

*Felt's Springs.*—They are on the side of the mountain, 1 mile W. of Strong's Creek and  $5\frac{1}{2}$  miles N.E. from Fortuna, in T. 3 N., R. 1 E. Fire has destroyed the hotel twice, and the improvements now consist of the bath-house and several small cottages for campers. There are three springs close together. The one farthest to the north is small but strongly impregnated with sulphur. The other two have an alkaline taste and a milky color.

*Humboldt Artesian Mineral Water Company.*—The well is situated at the edge of the bay, at Flannagan's mill, south of Eureka. It is 170 ft. deep and is double cased with 8 in. and 5 in. pipe. The flow, augmented by pumping, is estimated at 60,000 gallons per day. The water is charged artificially with carbonic acid under pressure of 30 to 130 lbs., according to size of bottles. It has an agreeable saline taste and finds a ready market in San Francisco and elsewhere as a table water.

*Analysis of Water from Humboldt Artesian Mineral Spring.*

	Grains per Imperial Gallon.
Sodium chloride.....	32.91
Calcium carbonate.....	16.37
Magnesium carbonate.....	10.63
Sodium carbonate.....	2.45
Silica.....	1.32
Alumina.....	.20
Iron oxide.....	.06
Sulphates.....	Traces.
Organic matter.....	Trace.
Carbonic acid.....	Abundant.

The water analyzed was purchased in open market, and the analysis shows the quality of the water furnished to the public. It differs from many natural mineral waters in the fact that it does not contain a single injurious ingredient.

WM. D. JOHNSTON, M.D.,  
Professor of Chemistry, etc., Cooper Medical College.

## INYO COUNTY.

*Boiling Springs.*—On the east side of Dry Salt Lake are several hot boiling alkaline springs.

*Saratoga.*—At the south end of Funeral range, and a little south of Death Valley, are located these pleasant springs. The resort, in spite of the uncanny names, is a good one and constantly growing in popularity.



*Sulphur*.—They are 6 miles S. of McComrich's well, in Desert Valley.

*Thermal Acid*.—These remarkable springs are found in the Coso range, 12 miles E. of Little Owens Lake. The soil around the springs is rich in pure crystallized sulphur.

*Volcanic Mineral*.—In Death Valley are several remarkable springs. Analysis by Prof. T. Price:

	Grains per U. S. Gallon.
Sodium chloride.....	1,840.72
Sodium carbonate.....	1,724.11
Sodium sulphate.....	651.02
Sodium sulphide.....	46.34
Potassium chloride.....	132.30
Magnesia and lime.....	Traces.
Silica.....	14.28
Organic matter.....	13.48
Iodine.....	Traces.
Bromine.....	Traces.
Iron.....	Traces.
Boracic acid.....	Traces.
Phosphoric acid.....	Traces.
Total solids.....	4,422.25
Gases not determined.	

#### KERN COUNTY.

*Agua Caliente*.—Thirty miles from Caliente Station are sulphuretted waters; temperature from 80° to 100° F.

*Warm Springs* are found in this county near the head of Walker's Basin.

*Warm Sulphur*.—On Poso Creek, near Simmons Valley, are warm sulphur springs, the waters of which are used locally for rheumatism and cutaneous affections.

#### LAKE COUNTY.

*Adams Springs*.—These are 8 miles S. of Clear Lake, and are mentioned in our VIIIth Report, p. 327, with analysis of the waters by Prof. T. Price.

*Allen Springs*.—Situated near the head of Cache Creek are five springs. An analysis of one of these by Dr. Winslow Anderson shows:

	Grains per Gallon.
Temperature, 58° F.	
Sodium chloride.....	23.16
Sodium bicarbonate.....	4.25
Sodium sulphate.....	.78
Potassium chloride.....	1.90
Magnesium bicarbonate.....	27.40
Potassium bicarbonate.....	.75
Magnesium chloride.....	.63
Calcium bicarbonate.....	20.14
Calcium phosphate.....	.55
Ferrous carbonate.....	.93
Organic matter.....	Trace.
Total solids.....	84.20
Carbonic acid gas.....	36 cu. in.

*Anderson Springs.*—They are 5 miles from Middletown, at the head of Lacoma Valley. They consist of nine mineral springs. The analysis of one of the springs by Dr. Winslow Anderson is as follows:

Temperature, 63° F.	Grains per Gallon.
Sodium chloride .....	1.09
Sodium carbonate .....	9.27
Sodium sulphate .....	6.18
Potassium salts .....	Traces.
Magnesium carbonate .....	11.73
Magnesium sulphate .....	16.95
Calcium carbonate .....	20.40
Calcium sulphate .....	9.10
Ferrous carbonate .....	.46
Arsenious salts .....	Traces.
Silica .....	2.45
Organic matter .....	Traces.
Total solids .....	77.63
Carbonic acid gas .....	243.50 cu. in.
Sulphuretted hydrogen .....	4.20 cu. in.

*Iron Spring.* (Analysis by E. G. Colby.)

Temperature 124° F.	Grains per U. S. Gallon.
Sodium chloride .....	.183
Sodium bicarbonate .....	.196
Sodium sulphate .....	3.421
Potassium sulphate .....	1.168
Magnesium sulphate .....	7.359
Calcium sulphate .....	10.884
Calcium phosphate .....	.154
Ferrous carbonate .....	1.184
Alumina .....	.093
Boracic acid (spectroscope) .....	Strong test.
Lithium (spectroscope) .....	Well-marked test.
Manganous carbonate .....	1.772
Silica .....	4.217
Organic matter .....	Small.
Total solids .....	30.631
Free carbonic acid gas .....	25.80 cu. in.

*Bartlett Springs.*—They are near the head of Cache Creek, in the north-eastern part of the county. The following analysis is by Dr. Winslow Anderson :

Temperature, 54° F.	Grains per U. S. Gallon.
Sodium chloride .....	.54
Sodium bicarbonate .....	1.21
Potassium bicarbonate .....	.36
Magnesium carbonate .....	7.74
Magnesium sulphate .....	1.62
Calcium carbonate .....	29.07
Calcium phosphate .....	.50
Calcium sulphate .....	.63
Ferrous carbonate .....	.51
Barium carbonate .....	Traces.
Silica .....	3.73
Lithium .....	Traces.
Borates .....	Traces.
Organic matter .....	Trace.
Total solids .....	45.91
Carbonic acid gas .....	224.56 cu. in.

*Bonanza Springs.*—See our VIIIth Report, p. 327.

*Harbin Springs.*—Situated 4 miles N.W. of Middletown, contains sulphurous and saline waters. Dr. Winslow Anderson gives the following analyses of the hot sulphur and other springs:

	Grains per U. S. Gallon.
Temperature, 122° F.	
Sodium chloride.....	23.05
Sodium carbonate.....	5.42
Sodium sulphate.....	10.19
Potassium carbonate.....	1.74
Magnesium carbonate.....	6.18
Magnesium sulphate.....	11.94
Calcium carbonate.....	9.10
Calcium sulphate.....	14.63
Ferrous sulphate.....	1.75
Arsenious salts.....	.07
Alumina.....	1.60
Silica.....	2.76
Organic matter.....	Trace.
Total solids.....	88.63
Carbonic acid gas.....	4.26 cu. in.
Free sulphuretted hydrogen.....	11.74 cu. in.

*Magnesia Spring.*

	Grains per U. S. Gallon.
Temperature, 60° F.	
Sodium chloride.....	1.72
Sodium carbonate.....	5.17
Sodium sulphate.....	4.32
Potassium salts.....	1.05
Magnesium carbonate.....	7.15
Magnesium sulphate.....	15.92
Calcium carbonate.....	8.43
Calcium sulphate.....	.93
Ferrous carbonate.....	.27
Arsenic.....	Trace.
Alumina.....	.68
Lithium.....	Trace.
Borates.....	Trace.
Silica.....	2.82
Organic matter.....	Trace.
Total solids.....	48.46
Free carbonic acid.....	17.25 cu. in.

*Iron Spring.*

	Grains per U. S. Gallon.
Temperature, 116° F.	
Sodium chloride.....	7.50
Sodium carbonate.....	14.22
Sodium bicarbonate.....	1.45
Sodium sulphate.....	5.25
Potassium chloride.....	Trace.
Potassium carbonate.....	1.78
Magnesium carbonate.....	4.16
Magnesium sulphate.....	6.11
Calcium carbonate.....	2.07
Calcium sulphate.....	Trace.
Ferrous carbonate.....	1.90
Alumina.....	.73
Silica.....	1.41
Organic matter.....	Trace.
Total solids.....	46.53
Carbonic acid gas.....	9.34 cu. in.

*Highland Springs.*—These are 8 miles S. from Lakeport, on the west side of Clear Lake, and are over twenty-five in number. The analyses of the five principal ones, made by Professor Rising, of the University of California, are given in our VIIIth Report, p. 328.



*Howard Springs.*—There are fourteen altogether, situated 6 miles from Lower Lake. The following analyses were made by Prof. W. T. Wenzell:

	Excelsior.	Twins.	Eureka.	Neptune.	Soda.
Temperature .....	75° F.	102° F.	110° F.	85° F.	60° F.
Free carbonic acid, cu. ins. per gallon.	134.00	77.50	150.00	120.00	117.00
<i>Solids.</i> (In grains per U. S. gallon.)					
Chloride of sodium .....	101.67	30.96	35.70	29.61	9.38
Chloride of potassium .....	1.13	19.71	25.65	14.64	12.81
Chloride of lithium .....	.35	.03	.09	.06	
Bicarbonate of soda .....	34.10	73.97	82.35		37.72
Bicarbonate of magnesia .....	2.81	114.10	110.25	73.34	59.32
Bicarbonate of lime .....	6.30	10.88	5.84	32.14	35.62
Bicarbonate of iron .....	1.85	1.14			
Alumina .....	.03	.15	.10	.19	.13
Oxide of iron .....			4.95	.20	.09
Silica .....	34.10	9.24	3.40	8.34	6.95
Organic matter .....	.14	.32	.20	.25	.20
Totals .....	182.48	260.50	268.53	158.77	162.22

*Mills Springs.*—See our VIIIth Report, p. 328.

*Saratoga Springs.*—See our VIIIth Report, p. 328.

*Seigler Springs.*—See our VIIIth Report, p. 328.

*Witter Mineral Springs.*—There are several springs, the principal one, known as the Dead Shot, has been analyzed by Dr. Winslow Anderson, as follows:

	Grains per Gallon.
Temperature, 59.3°.	
Sodium chloride .....	17.42
Sodium carbonate .....	5.96
Sodium sulphate .....	11.50
Potassium carbonate .....	3.15
Magnesian carbonate .....	7.10
Magnesian sulphate .....	20.62
Ferrous carbonate .....	1.17
Manganese carbonate .....	.86
Alumina .....	1.65
Borates .....	.42
Silica .....	6.33
Organic matter .....	.76
Total solids .....	76.94
Carbonic acid gas .....	7.65 cu. in.
Sulphuretted hydrogen .....	5.25 cu. in.

## LASSEN COUNTY.

*Big Hot.*—It is 3 miles N. of Honey Lake, and is a large hot saline spring, several feet in diameter; temperature, 200° F. The water is constantly boiling up in a large stream.

*Brenbeck's Boiling.*—On the east side of Honey Lake is one large boiling alkaline spring.

*High Rock.*—Nine miles E. of Honey Lake; alkaline water; temperature, 100° F.

*Mud Springs.*—Extensive hot mud springs are situated 15 miles N.E. of Honey Lake.

*Shafer's Hot.*—They have a temperature of 210° F., and contain salines and sulphates; are situated at the north end of Henry Lake.

## LOS ANGELES COUNTY.

*Encino Springs.*—On the Encino ranch, near Los Angeles City, are a number of warm alkaline and carbonated springs, having a temperature of 90° F. Analysis by Oscar Loew:

	Parts in 1,000.
Sodium carbonate.....	24.31
Calcium carbonate.....	32.17
Sodium sulphate.....	54.46
Sodium chloride.....	2.93
Silica.....	11.50
Total solids.....	125.37
Carbonic acid in excess.	

*Fulton Wells.*—These wells are 13 miles from Los Angeles City. The two principal wells are 350 ft. deep and flow copiously. Analysis by Winslow Anderson, M.D.:

	Grains per U. S. Gallon.
Sodium chloride.....	9.60
Sodium bicarbonate.....	2.90
Sodium sulphate.....	.95
Magnesium bicarbonate.....	17.45
Ferrous carbonate.....	11.75
Calcium carbonate.....	12.62
Calcium sulphate.....	23.41
Silica.....	2.45
Organic matter.....	Trace.
Total solids.....	81.13

## MENDOCINO COUNTY.

*California Seltzer Springs.*—They are 12 miles from Cloverdale, with picturesque surroundings. The waters are sparkling and carbonated. Analysis by Winslow Anderson, M.D.:

	Grains per U. S. Gallon.
Temperature, 57° F.	
Sodium chloride.....	17.15
Sodium bicarbonate.....	53.00
Magnesium carbonate.....	44.60
Calcium carbonate.....	72.40
Ferrous carbonate.....	Trace.
Silica.....	Trace.
Organic matter.....	Trace.
Total solids.....	187.15
Free carbonic acid gas.....	18.00 cu. in.

*Duncan Mineral Springs.*—They are 1¼ miles S.W. of Hopland, on the S. F. & N. P. R. R. There are seven springs, and the chief mineral constituents are magnesia, lime, and soda, held in solution by free carbonic acid gas. O. Howell, of Hopland, owner.

*Vichy Springs* are situated in Doolan Cañon, 3 miles N.E. from Ukiah. The water issues from under a bed, 15 to 20 ft. thick, of calcareous tufa, and is thence conveyed through wooden pipes to the bath-houses. It has a peculiar alkaline but not disagreeable taste, and is rather liked by visitors. There are three springs; the upper one (Crystal Spring), is cold and is not used for bathing. The Vichy Spring is the largest, yielding about 20 in. of water. The Ardeche Spring yields about 8 in. of water. The last two are warm and are used in the baths. Surrounding the baths are several hotel buildings and cottages. The grounds have been

tastefully arranged so as to give shade and comfort during the heat of the day.

*Vichy Spring.* (Analyzed by Winslow Anderson, M.D.)

Temperature, 93° F.	Grains per U. S. Gallon.
Carbonate of soda .....	195.52
Carbonate of lime .....	18.14
Carbonate of magnesia .....	19.75
Carbonate of iron .....	.07
Chloride of sodium .....	28.60
Chloride of potassium .....	.09
Silica .....	5.92
Total solids .....	224.75
Free carbonic acid gas .....	224.75 cu. in.

*Crystal Spring.* (Analyzed by Prof. Thos. Price.)

Temperature, 45° F.	Grains per U. S. Gallon.
Carbonate of soda .....	142.69
Biborate of soda .....	9.25
Chloride of sodium .....	22.51
Chloride of potassium .....	2.11
Carbonate of lime .....	21.69
Carbonate of magnesia .....	11.66
Carbonate of iron .....	.96
Silica .....	1.86
Total solids .....	212.73

*Ukiah Water Supply.*—A pumping plant has been established on the bank of Russian River. The water, which is clear and pure, is raised from a shallow well (20 ft.) to a 250,000 gal. reservoir, 200 ft. above the town, and thence brought through a 10 in. pipe to the consumers.

MODOC COUNTY.

*Alkaline Lakes.*—Several large sheets of alkaline waters fed by springs are found 15 miles S.E. of Alturas.

*Boyd's Hot.*—They are in Surprise Valley; the waters are alkaline and heavily charged with carbonic acid gas.

*Coal Valley Boiling.*—They are 8 miles W. of Canby, and are truly boiling, having a temperature of 214° F.

*Stuart's Hot.*—They are located in Warm Spring Valley, and are attracting considerable attention.

MONO COUNTY.

*Alkali.*—Several alkali springs are found in the north end of the county.

*Benton Hot.*—They are near Benton, and one of them has a diameter of 18 ft.; temperature, 135° F. The waters are slightly alkaline, and much used for bathing purposes.

*Black Lake.*—It is 1 mile W. of Benton, and is fed by several springs. The water is sulphuretted and saline.

*Boiling Sulphur.*—There are several sulphuretted alkaline boiling springs on the south branch of Owens River, N.W. of Long Valley.

*Casa Diablo Hot.*—These are 10 miles E. of Mammoth. The waters are saline and sulphuretted. Farther up the road are a number of small steaming boiling geysers.

*Mono Basin Warm.*—These waters are chlorinated and alkaline, and are located on the northeast shore of Mono Lake.



*Mono Lake.*—This is 14 miles in length; its greatest breadth is 9 miles. Analysis by Dr. Winslow Anderson:

	Grains per U. S. Gallon.
Sodium chloride.....	795.24
Sodium carbonate.....	26.40
Sodium sulphate.....	17.10
Sodium phosphate.....	5.93
Potassium chloride.....	281.17
Potassium carbonate.....	10.60
Potassium phosphate.....	3.05
Magnesium chloride.....	365.60
Magnesium carbonate.....	9.45
Magnesium sulphate.....	127.50
Calcium chloride.....	1,075.55
Calcium carbonate.....	52.76
Calcium sulphide.....	Trace.
Calcium sulphate.....	57.07
Ferrous carbonate.....	7.14
Alumina.....	26.63
Borates.....	19.75
Silicates.....	9.62
Organic matter.....	24.60
Total solids.....	2,915.16
Free carbonic acid gas.....	17.16 cu. in.
Free sulphuretted hydrogen.....	.62 cu. in.

#### MONTEREY COUNTY.

*Bane's Soda Springs.*—These are about 6 miles S.W. of the Cruikshank mines, on a steep hill facing the ocean. Springs bearing lime in solution, and leaving a heavy deposit of aragonite, issue for a long distance along the cliffs in this vicinity. The main spring is richly impregnated with carbonic acid and iron, in addition to other ingredients. It has formed a very beautiful terrace on the steep slope, the terrace rising 20 ft. almost vertically on its lower side and having a flat top. From the center of this flat top the spring issues and flows over and down the vertical face of the terrace, leaving a deep red stain, which extends even to the ocean, while 100 ft. above dripping lime water has formed a stalactitic cave. Another spring, carrying iron and carbonic acid, issues at the base of the cliffs near the ocean. These springs are accessible by road and rough trail from San Simeon.

*Dolan's Hot Sulphur Spring.*—This thermal spring is on the North Fork of Big Creek, in a deep redwood cañon about  $1\frac{1}{2}$  miles from the ocean. A large stream of warm sulphur water issues from the south side of the cañon, leaving a considerable deposit of a white ropy substance, similar to that of the White Sulphur Springs. The temperature is probably not over 100°. The spring is 7 miles down the coast from Slate's, over rough trails.

*Helm's Soda Springs.*—Three miles E. of Bane's Springs, at an elevation of 1,600 ft. above the ocean, is another series of springs, very richly impregnated with carbonic acid. The amount of water is not great, nor are there apparently any minerals present.

*Paraiso Springs.*—These springs are situated 7 miles S.W. of Soledad, in a cañon of the Soledad Hills. Here are a number of mineral springs, including warm and cold soda springs, the warm spring having a temperature of 118° F., and an iron spring, besides several others more or less mineralized. They are used for both drinking and bathing, more particularly the latter, being especially efficacious in cases of rheumatism.

*Slate's Hot Sulphur Springs.*—These springs are 20 miles below Point Sur. They issue from the side of a bluff facing the ocean, being scattered along a distance of a quarter of a mile. Several issue from the bed of Hot Spring Creek. The temperature of the hottest one is 130° F. and the volume of water great. The different springs show a somewhat varying composition. They issue from shale and sandstone of the pre-Cretaceous series, which is here considerably metamorphosed. The springs are accessible by trail from the Sur.

*Tassajara Springs.*—They are in a deep cañon, tributary of the Arroyo Seco, in the heart of the Santa Lucia Mountains. They are reached by road from Salinas, and by road and trail from Soledad up the Arroyo Seco. The elevation is about 1,400 feet. Here are eighteen springs, varying in temperature from 124° to 150° F. They issue from crystalline schists in the bed of the creek and southern bank. In addition to sulphur, the springs carry magnesia and some other minerals. They are used for both drinking and bathing, more particularly the latter, being especially efficacious in cases of rheumatism.

## NAPA COUNTY.

*Calistoga Springs.*—See our VIIIth Report, p. 416. They consist of twenty hot salt springs, situated east of the town of Calistoga.

*Etna Springs.*—See our VIIIth Report, p. 416. They are at the head of Pope Valley, 16 miles N.E. from St. Helena, and comprise six springs. Their temperatures vary from 98° to 106° F.

*Napa Soda Springs.*—See our VIIIth Report, p. 416. These are 6 miles N.E. of Napa City. There are twenty-seven springs, and the waters are saline, with a temperature of 68° F.

*Samuels' Soda Springs.*—Situated 20 miles E. of St. Helena, on a branch of Pope Creek, in a narrow, steep cañon. An analysis made under Professor Hilgard's care gives the following:

	Grains per U. S. Gallon.
Silica .....	4.78
Potassium sulphate .....	2.99
Sodium chloride .....	21.35
Sodium bicarbonate .....	15.95
Lithium (with spectroscope) .....	Well-marked trace.
Calcium carbonate .....	1.24
Calcium sulphate .....	.25
Calcium phosphate .....	.58
Strontium carbonate (spectroscope) .....	Slight test.
Magnesian carbonate .....	37.78
Iron carbonate .....	.95
Boracic acid .....	Marked test.
Organic matter .....	Traces.
Total solids .....	85.87
Free carbonic acid gas .....	278.16 cu. in.

*White Sulphur Springs.*—See our VIIIth Report, p. 417. These are 2½ miles S.W. from St. Helena, with nine sulphuretted springs, the temperatures varying from 69° to 89° F.

## PLACER COUNTY.

*Rubicon Soda.*—These mineral soda springs are romantically situated in Garden Valley, on the Rubicon River, about 11 miles W. of Lake Tahoe. Everything surrounding them partakes of the picturesque; the

tall mountains, covered with groves of pine and spruce, and capped by old century cedars. The mineral springs themselves belong to the alkalo-carbonated class of waters.

*Summit Soda Springs.*—They are located in an expansion at the head of the deep cañon along which winds one of the forks of the American River. The surroundings are exceedingly picturesque. The air is pure, dry, and invigorating, and cool and pleasant during the heated summer season; altitude, 6,009 ft. Analysis by Dr. Winslow Anderson:

	Grains per U. S. Gallon.
Sodium chloride .....	26.18
Sodium bicarbonate .....	4.11
Sodium carbonate .....	5.75
Potassium carbonate .....	.82
Magnesium carbonate .....	4.05
Calcium bicarbonate .....	38.93
Calcium carbonate .....	6.55
Ferrous oxide .....	Trace.
Ferrous carbonate .....	2.70
Borates .....	Trace.
Alumina .....	1.13
Silica .....	1.94
Organic matter .....	Trace.
Total solids .....	92.16
Free carbonic acid gas .....	187.25 cu. in.

#### PLUMAS COUNTY.

*Boiling Lakes.*—Seven miles S. of Lassen's Peak are a number of hot bubbling and boiling alkaline springs. They are located quite close together, and several of them coalesce, forming lakes.

*Cold Soda Lake.*—This alkaline sheet of water is near the head of Mill and Battle creeks, S. of Lassen's Peak. It is fed by many small springs bubbling up all over its bottom. The water is palatable and sparkling.

*Dr. Soupan's.*—These hot sulphur springs are at the head of the road on a branch of Battle Creek. The surroundings are picturesque.

*Geysers.*—Near the mouth of Willow and Warner creeks are found a number of small geyser springs. The temperature is near the boiling point, and sulphurous steam and vapors rise from 20 to 50 ft. into the air.

*Steamboat Springs.*—S.E. of Lassen's Peak are located a number of boiling springs, which spout and puff as they issue from the earth's crust.

#### SAN BERNARDINO COUNTY.

*Arrowhead Hot.*—These springs are located 10 miles from Colton, in the San Bernardino Mountains; altitude, 1,600 ft. The springs number twenty or more and the combined volume of hot water issuing from the granite and limestone formation is very large. It has been likened to a good-sized millstream (Blake). The water is very hot, several springs having a temperature ranging from 108° to 210° F. The springs form one of the tributaries of the Santa Ana River.

*Bitter.*—This cool saline spring is situated 18 miles N. of Camp Cody. The water is rich in magnesium sulphate (Epsom salt), hence its name.

*San Juan Capistrano.*—These springs are light carbonated, and much used in the southern portion of the State. They are near Capistrano. Analysis by Oscar Loew:



	Parts in 100,000.
Sodium chloride.....	10.50
Sodium carbonate.....	11.10
Sodium sulphate.....	Trace.
Potassium carbonate.....	Trace.
Calcium carbonate.....	Trace.
Magnesium carbonate.....	Trace.
Lithia.....	Trace.
Silica.....	7.66
Total solids.....	29.29

## SAN DIEGO COUNTY.

*Aqua Caliente.*—These hot sulphuretted springs are on Warner's ranch, 50 miles from San Diego City. Analysis by Oscar Loew:

	Grains per U. S. Gallon.
Sodium carbonate.....	8.3
Sodium sulphate.....	Trace.
Sodium chloride.....	31.0
Lime.....	Trace.
Magnesia.....	Trace.
Lithia.....	Trace.
Silica.....	Trace.
Organic matter.....	Trace.
Total solids.....	39.3

*Coronado Springs.*—Analyses by C. Gilbert Wheeler:

	Coronado, Cal.	Bethesda, Wis.
	Grains per U. S. Gal.	Grains per U. S. Gal.
Sodium chloride.....	10.168	1.160
Sodium carbonate.....		.872
Sodium sulphate.....		.544
Potassium chloride.....	.912	
Potassium sulphate.....	.552	.456
Magnesium carbonate.....	4.728	7.344
Calcium carbonate.....	6.488	11.824
Calcium sulphate.....	1.328	
Ferrous oxide.....	.040	.032
Alumina.....		.120
Silica.....	1.080	.728
Organic matter.....	.922	1.984
Total solids.....	26.288	25.064

*Corral de Luz.*—These sulphuretted warm springs are near Oceanside, in a valley about 8 miles from the ocean. The waters range in temperature from 85° to 135° F.

*Dos Palmas.*—The springs are in Coahuila Valley, and have an average temperature of 90° F. The mineral constituents are chiefly salt and sulphates of lime and magnesia.

*Elsinore.*—In a little valley close to Elsinore there are nearly two hundred springs, some cold and others nearly boiling. "The cold springs are carbonated, containing soda, magnesia, and iron; the hot waters are sulphurous, with lime, magnesia, and borax." (Dr. Winslow Anderson.)

## SAN LUIS OBISPO COUNTY.

*Arroyo Grande.*—These springs are located 14 miles N. of San Luis Obispo City. The waters are alkaline and carbonated, and are much used locally.

*El Paso de Robles.*—These valuable hot and cold sulphur springs are in the beautiful valley of the Salinas River, 16 miles from the shores of the Pacific and 216 miles from San Francisco. The once wild "pass in the oaks" is now transformed into a blooming resort, with cultivated grounds, and Paso Robles is a delightful little town of about 1,000 inhabitants.

	Profs. Price and Hewston's Analysis, 1872.	Dr. Winslow An- derson's Anly- sis, 1889.
	Grains per Imp. Gal.	Grains per U. S. Gal.
Sodium chloride.....	27.18	25.73
Sodium bicarbonate.....	50.74	41.19
Sodium carbonate.....		7.62
Sodium sulphate.....	7.85	7.25
Sodium iodide.....		Trace.
Sodium bromide.....		Trace.
Potassium chloride.....		1.57
Potassium carbonate.....		2.05
Potassium iodide.....		Trace.
Potassium sulphate.....	.88	Trace.
Magnesian bicarbonate.....	.92	
Magnesium carbonate.....		2.15
Magnesium sulphate.....		5.11
Calcium carbonate.....		1.23
Calcium sulphate.....	3.21	2.94
Ferrum peroxide.....	.36	.73
Borates.....		Trace.
Lithates.....		Trace.
Alumina.....	.22	.25
Silica.....	.44	1.75
Iodides and bromides.....	Trace.	
Organic matter.....	1.64	1.90
Total solids.....	93.44	101.47
Free sulphuretted hydrogen.....	4.45 grains.	3.75 cu. in.
Free carbonated acid gas.....	10.50 grains.	8.90 cu. in.

*Santa Ysabel.*—Several of the most valuable mineral springs in the State are  $2\frac{1}{2}$  miles S.E. of Paso Robles; altitude, 1,000 ft. Analysis by Dr. Winslow Anderson:

	Grains per U. S. Gallon.
Sodium chloride.....	18.10
Sodium bicarbonate.....	29.04
Sodium carbonate.....	6.91
Sodium sulphate.....	7.25
Sodium iodide.....	Trace.
Potassium bromide.....	Trace.
Potassium iodide.....	Trace.
Potassium chloride.....	Trace.
Potassium carbonate.....	.83
Magnesium carbonate.....	6.16
Magnesium sulphate.....	4.85
Calcium carbonate.....	2.45
Calcium sulphate.....	2.32
Manganese carbonate.....	.13
Ferrous carbonate.....	.98
Borates.....	Trace.
Alumina.....	.73
Barium salts.....	Trace.
Silica.....	1.68
Total solids.....	81.43
Free sulphuretted hydrogen.....	4.65 cu. in.
Free carbonic acid gas.....	11.75 cu. in.

## SANTA BARBARA COUNTY.

*Cuyano Hot.*—These sulphuretted springs are located in the cañon and valley of Cuyano.

*Las Cruces Hot.*—These sulphur springs are 42 miles from the city of Santa Barbara. The waters are saline and sulphuretted; temperature, 90° F.

*Montecito Hot.*—These springs are 5 miles from the city of Santa Barbara. The waters are sulphuretted, and nearly all boiling hot. A resort is being erected for the treatment of invalids, and suitable bathing facilities provided.

*Mountain Glen Hot.*—These sulphuretted springs (temperature, 60° to 100° F.) are about 25 miles N. of Santa Barbara.

*San Marcos.*—These sulphur waters are 7 miles N.W. of Santa Barbara. They have a temperature of 120° F., and are used locally for skin diseases, etc.

## SANTA CLARA COUNTY.

*Alum Rock Springs.*—These springs are in a romantic cañon with an unromantic name, "Penitentiary Cañon," about 7 miles N.E. of San José.

	Grains per U. S. Gallon.
Sodium chloride .....	10.21
Sodium carbonate .....	7.14
Potassium carbonate .....	.76
Magnesium carbonate .....	8.92
Magnesium sulphate .....	7.16
Calcium carbonate .....	19.05
Magnesium carbonate .....	Trace.
Ferrous carbonate .....	Trace.
Alumina .....	6.45
Silica .....	2.52
Total solids .....	62.21
Free carbonic acid gas in excess.	

*Pacific Congress.*—These mineral springs are in the Coast Range Mountains, about 12 miles S.W. of San José. They are so named from the similarity which exists between the waters of these springs and those of the noted Congress Springs at Saratoga, New York.

	Dr. Winslow Anderson, Analyst.	Bauer or Thayer, Analyst.
	Grains per U. S. Gal.	Grains per U. S. Gal.
Sodium chloride .....	115.76	119.15
Sodium carbonate .....	120.42	123.35
Sodium sulphate .....	12.95	12.14
Potassium carbonate .....	2.06	
Magnesium carbonate .....	26.34	
Magnesium sulphate .....	14.17	
Calcium carbonate .....	16.03	17.29
Calcium sulphate .....	14.19	
Ferrous carbonate .....	13.87	14.03
Alumina .....	4.50	
Silica, alumina, and magnesia .....		49.98
Silica .....	3.98	
Organic matter .....	Trace.	
Total solids .....	334.27	335.94
Free carbonic acid gas .....	44.17 cu. in.	Cu. in. not determined.



## SHASTA COUNTY.

*Castle Rock.*—These springs are near the foot of Mount Shasta. The waters are sulphuretted and carbonated soda. Locally they are used for rheumatic troubles.

*Chalybeate.*—On Bear Creek, N.W. of Fort Creek, near the head of Falls River, are several springs, highly carbonated and containing considerable ferrous carbonate. They are very pleasant to the taste.

*Hibbs' Soda.*—They are located 62 miles N. of Redding. The water is sparkling and pleasant; the chief mineral ingredient is sodium carbonate.

*Lower Soda.*—They are opposite the mouth of Castle Creek. The waters are alkaline and carbonated, and contain considerable amounts of iron carbonate.

## SIERRA COUNTY.

*Campbell's Hot.*—They are one mile from the town of Sierraville. There are three springs, one cold, the other two hot; temperature, 104° F. The waters are slightly saline and mildly sulphuretted. There is good fishing and hunting in the immediate neighborhood.

## SISKIYOU COUNTY.

*Carbonated.*—They are located on Shovel Creek road, in the northern part of the county. They have an agreeable soda taste, and are much used locally.

*Frey's Soda.*—These springs lie near the line between Shasta and Siskiyou counties. The waters are alkaline and carbonated. Temperature, 52° F.

*Klamath Hot.*—They are in the wild and picturesque country of the Mount Shasta region; altitude, 2,700 ft. With snow-capped mountain peaks and hills clad in evergreen forest groves, the saline sulphuretted springs have become as much noted for the surrounding scenery as for the therapeutic properties of the waters. They are 18 miles from Ager.

## SOLANO COUNTY.

*Tolenas.*—These are located about 5 miles N. of Suisun, adjoining the Tolenas "onyx" quarries. Altitude, 1,235 ft.

	Dr. Winslow Anderson, Analyst.	J. Hewston, Jr., M.D., Analyst.
	Grains per U. S. Gal.	Grains per U. S. Gal.
Sodium chloride .....	194.16	215.92
Sodium carbonate .....	46.93	53.36
Sodium bicarbonate .....	6.45	-----
Sodium baborate .....	19.13	20.56
Potassium chloride .....	6.47	5.68
Potassium iodide .....	1.75	2.08
Magnesium carbonate .....	11.58	10.88
Calcium carbonate .....	49.80	48.32
Ferrous carbonate .....	.89	.64
Alumina .....	1.10	.96
Silica .....	1.92	1.60
Organic matter .....	Trace.	Trace.
Total solids .....	340.18	360.00
Free carbonic acid gas .....	31.27 cu. in.	33.73 cu. in.

*Vallejo Sulphur.*—Near Vallejo are several sulphur springs, which are used considerably locally. The temperature ranges from 80° to 90° F. The waters act well on torpid portal circulation.

## SONOMA COUNTY.

*Aqua Caliente Thermal Mineral Springs.*—They are fully described in our XIth Report, p. 458.

*Aqua Rica Springs.*—They are near Verano, on the Donahue Railroad. There are five principal springs. Analyses by John T. Evans, chemist:

	No. 1.	No. 2.
Potassium sulphate.....	.345	.492
Potassium chloride.....	.701	.....
Sodium chloride.....	34.961	.577
Sodium carbonate.....	1.785	.620
Lithium carbonate.....	Traces.	Traces.
Calcium carbonate.....	2.771	2.102
Magnesium carbonate.....	.175	1.216
Ferrous carbonate.....	.066	.....
Silica.....	6.014	6.399
Boracic acid.....	Traces.	Traces.
Sulphuretted hydrogen.....	.088	Traces.
Crenic and other organic acids.....	.169	Traces.
Total solids.....	47.075	11.500

Results are expressed in grains per U. S. gallon. The silica is present in the water in the free hydrated state.

*Burns' Springs.*—They are situated among the picturesque hills 3½ miles E. of Glen Ellen, and are all of icy coldness. One of these springs contains a large amount of iron, clearly shown in the deposits about the spring. An attractive summer home is being erected near the springs by Owen Burns, the owner.

*Geysers.*—See our VIIIth Report, p. 636.

*Litton Springs.*—See our VIIIth Report, p. 634.

*Mark West Springs.*—See our VIIIth Report, p. 634.

*Skaggs Springs.*—See our VIIIth Report, p. 634.

## TEHAMA COUNTY.

*Tuscan or Lick Springs.*—These springs are located about 9 miles N.W. of Red Bluff, on the Sacramento River, in Tehama County. They lie in the center of a rough and rugged country showing signs of extinct volcanic action, at an elevation of about 600 ft. In this volcanic region of Tuscan are upwards of one hundred springs. Three only are in active use, and are known as the Red Spring, the White Spring, and the Black Spring. The Red Spring was analyzed by Dr. F. W. Hatch several years ago, and resembles somewhat the famous Blue Lick Springs, of Kentucky.

## NATURAL GAS.

Natural gas is a mineral product which is found in all the bituminous formations of California, but it has attracted the most attention in the Sacramento and San Joaquin valleys, where public interest has been aroused by the practical use which has been made of natural gas at the city of Stockton.

*Fuel Values of Natural Gas.*—A series of experiments were made by the State Mining Bureau to determine the fuel value of the natural gas in the Central Valley of California, and, taking coke carrying 10 per cent of ash as a standard of comparison, in round figures, the following results were obtained:

1,000 cu. ft. of average Stockton gas.....	= 50 lbs. of coke
1,000 cu. ft. of gas from old well at Sacramento.....	= 34 lbs. of coke
1,000 cu. ft. of gas from spring on the Barker ranch.....	= 58 lbs. of coke
1,000 cu. ft. of gas from well, Sunset Oil District, Kern County.....	= 53 lbs. of coke

It will be observed that the value of the natural gas to consumers, as represented by the saving effected by its use, is greatly in excess of the value expressed by the calorific equivalents of the gas. This has been the experience in the Eastern States, as referred to in our Bulletin No. 3 on the "Gas and Petroleum Yielding Formations of the Central Valley of California." Nevertheless, the comparative calorific value of hydrocarbon gases is the most reliable basis on which to estimate their relative worth.

A line of inquiry was conducted by our department to determine whether the occurrence of natural gas in valuable quantities at Stockton is peculiar to that locality, or whether it is probable that a similar supply may be obtained by boring in other portions of the Central Valley of California. This necessitated a comparison of the geological conditions under which the natural gas is found at Stockton, with what may reasonably be supposed to be the geological conditions prevailing throughout the Sacramento and San Joaquin valleys. Investigation leads to the conclusion that the principal source of the gas in the Sacramento Valley are the Cretaceous rocks. In the San Joaquin Valley there are bituminous rocks of both Cretaceous and Tertiary age which yield inflammable gas. An examination of the records of the wells which have been bored in the valley lands, as given in our VIIIth, Xth, and XIth Reports and Bulletin No. 3, demonstrates that the natural gas is stored in porous strata which are geologically more recent than the bituminous formations above referred to. These gas-holding porous strata underlie sheets of clay which are first encountered at no great depth beneath the surface throughout the Central Valley of California. It is also probable that any organic remains which have been subjected to the necessary chemical change beneath the clayey strata of the valley have contributed to the gas stored in the adjacent porous formation.

It has been shown in our Bulletin No. 3 that the porous formations suitable for storing gas and oil, and which probably underlie the San Joaquin Valley, are several thousand feet thick. There has not been sufficient evidence to determine the area throughout which these porous strata extend, but investigation warrants a belief that they are coextensive with the central portion of the valley, and that the alluvial formations on the sides of the valley are either connected with the gas-yielding



rocks or isolated therefrom, according as the intervening strata are composed of either sand or clay. The researches of our department in this connection lead to the conclusion that the conditions prevailing in the San Joaquin Valley are somewhat more favorable than they are in the Sacramento Valley, for the showing of hydrocarbons in the Cretaceous rocks of the Sacramento Valley is much less than it is collectively in the Cretaceous and Tertiary rocks of the San Joaquin. An examination of the records of the Stockton gas wells shows that the average thickness of gas-yielding strata for wells 1,600 to 1,700 ft. deep may be put down approximately at 150 ft. Below that depth the proportion of gas-yielding strata greatly increases; and it is the opinion of those who have bored deeper wells at Stockton that below a depth of 1,700 ft. all the porous strata yield gas.

Concerning the tension of the gas, the problem is complicated by the presence of flowing water, which has been struck in nearly all the gas wells hitherto bored in the valley lands. There is no doubt that if the water could be kept out of the casing without impeding the flow of gas, the amount of gas yielded by the wells would be greatly increased. It is quite likely also that if the water could be excluded the quality of the gas would be improved, for the principal dilutant of the gas appears to be nitrogen, which in all probability is largely derived from air which is drawn down with the water when it sinks into the ground at the head of the artesian system.

It is a reasonable conclusion that other cities in the San Joaquin Valley besides Stockton may obtain natural gas in valuable quantities by boring wells of less than 3,000 ft. in depth. It is to be hoped that the subject of natural gas will be further investigated by boring in the Sacramento Valley, where appearances indicate that in some places sufficient gas might be obtained to be of practical value if it could be used on the spot.

The gas-yielding formations of the San Joaquin and Sacramento valleys are in proximity to the mines of the Sierra, to beds of pottery clay, and to sand suitable for the manufacture of glass. The localities where the principal gas wells are situated, or may yet be bored, possess water communication with the harbor of San Francisco. It needs no stretch of imagination to appreciate the fact that natural gas is an important factor in the geological economics of the Central Valley of California.

#### HUMBOLDT COUNTY.

*Humboldt Land and Oil Company's Well.*—During the summer of 1893 another well was sunk in the Upper Mattole country, in T. 4 S., R. 2 E. Finding the oil sand at a depth of 800 ft. poor in oil, the hole was capped and work stopped for the present. The formation passed through was gray shale, with an occasional seam of harder clay rock. Casing used was  $7\frac{1}{2}$  and  $5\frac{1}{2}$  in. to a depth of 695 ft., where the oil sand was struck; beyond that no casing was put in. At a depth of 135 ft. some gas came up, but was piped off; at 700 ft. a strong flow of gas was struck, sufficient to furnish light and fuel for the drilling plant. Some distance east of the well the oil sand crops out and shows 20 ft. of coarse gray sand impregnated with oil. It dips  $60^{\circ}$  N.E.

## SACRAMENTO COUNTY.

*Sacramento Natural Gas and Water Company.*—This company have bored two wells in the southwestern part of the city of Sacramento. The well which was first bored is 876 ft. deep. The formation penetrated is alternate strata of clay, gravel, and cement, and quicksand; the lower portion of the formation being a hard, porous, sandy cement. Flowing water was struck in coarse sand at a depth of 281 ft., and a slight showing of gas was observed at 392 ft. The flow of water and gas increased with the depth. Operations were suspended, owing to an accident to the casing, at the depth of 866 ft. It is roughly estimated that the flow of gas from this well exceeded 2,000 ft. in twenty-four hours. In March, 1892, a second well was commenced about 150 ft. eastward from the first gas well. In May, 1893, this well had been bored to a depth of 965 ft., but the boring was suspended, owing to difficulty resulting from a sand pump having become fast at the bottom of the casing. The well-borers state that many of the strata penetrated by this well were very hard and required reaming; also that the greatest trouble resulted from the sand packing around the casing when it was standing on a hard stratum during the process of reaming. This well yields flowing water and inflammable gas. The officers of the company state that efforts are being made to recover the tools lost in the second well.

## SAN JOAQUIN COUNTY.

In Stockton and vicinity there are more than twenty wells which yield natural gas in sufficient quantities to be of commercial value. Indeed, for the last five years it has been an established fact that at Stockton, by boring to a depth of something less than 2,500 ft., sufficient gas can be obtained to materially reduce the fuel bill of a large factory, or to supply a group of families with light and fuel. The following gas wells have recently been completed at Stockton:

*Asylum Well No. 3.*—This was commenced in 1892, and was bored to a depth of 1,992 ft., when work was suspended. This well is cased with 15 in. casing, No. 14 iron, to a depth of 854 ft.; thence to a depth of 1,422 ft. with 13½ in. casing; thence to 1,671 ft. with 12 in. casing; thence to 1,775 ft. with 10½ in. casing; thence to 1,780 ft. with 8 in. casing; thence to 1,786 ft. with 7 in. casing; thence to 1,979 ft. with 6 in. casing.

*Central Gas Well.*—This is situated at the corner of Miner Avenue and American Street. It is owned by a private company, who obtain their supply of gas for fuel and lighting from this well. In 1893, a depth of about 1,500 feet was reached, but tools were lost in the well, and as sufficient gas had been obtained to supply the parties interested, it was determined not to incur the expense of recovering the tools. The well was capped and the gas turned into a main, from which the parties using the gas are supplied. This well is cased with 13 in. casing to a depth of 800 ft.; thence to a depth of 1,100 ft. with 11 in. casing; thence to 1,150 ft. with 9 in. casing; thence to 1,500 ft. with 6 in. casing.

*Grant Street Well.*—Operations were suspended on this well in November, 1893, in order that the gas might be used by the Stockton Natural Gas Company, who own the well, and who require an accession to their supply of natural gas during the winter.

*Cost and Yield of Stockton Gas Wells.*—The following table will give some idea of the cost of boring and value of the Stockton gas wells. The volume of gas yielded by the Asylum wells was estimated by a field assistant of this department, who noted the time required to fill the gasometer at the Asylum wells, at a time when it was said that no gas was being used from this source. The other data relating to the wells mentioned in the following table are obtained from estimates made by the owners or parties in charge of the wells:

Name of Well.	Yield of Gas in 24 Hours, in Cubic Feet.....	Cost of Well and Plant.....	Depth of Well, in Feet.....	Monthly Saving Effectuated by use of Gas .....	Owners, and Remarks.
Asylum Well No. 1 .....		-----	1,750		
Asylum Well No. 2 .....	34,000	-----	1,992	\$500	
Court-House Well .....	30,000	\$12,000	1,917	300	
St. Agnes Well No. 1 .....		-----	960		
St. Agnes Well No. 2 .....	20,000	10,000	1,720	100	
Jackson Well No. 1 .....	16,700	-----	1,655		Gas sold to Stockton Gas Light and Heat Co.
Jackson Well No. 2 .....	14,000	12,000	1,400		
Haas Well No. 1 .....	80,000	-----	*3,000		Stockton Natural Gas Co., whose rates are \$1 per 1,000 ft. or less, and 50 cts. for each additional 1,000 ft. Payable weekly.
Haas Well No. 2 .....	43,000	-----	2,000		
The Citizen Well .....	50,000	26,000	2,061		Private company, whose rates are \$1 per each 1,000 ft. up to 5,000, and 60 cts. per each 1,000 ft. in ex- cess of 5,000 ft. Payable monthly.
The Central Well .....	19,400	15,000	1,500		Used by stockholders of the company.

\* Reported to be nearly 3,000 feet.

#### SISKIYOU COUNTY.

*Well on Prather Ranch.*—In August, 1893, a well was commenced on the Prather ranch (owned by the Shasta Land and Cattle Company), near Montague, the object being to prospect for flowing water, gas, and oil. This experimental boring was undertaken by the Shasta Land and Development Company, of Oakland. The well-borer employed is C. W. Fox, who states as follows: "The formation penetrated consists principally of grayish sandstone interstratified with black sand and white quartz pebbles. At the depth of 88 ft., an auriferous cemented gravel was encountered, which is about 18 ft. in thickness. At 138 ft. a few fossil shells were brought up by the sand-pump. At 280 ft. about 4 miner's inches of fresh water flowed from the casing. At 400 ft. inflammable gas was struck, and it burned with a flame about 18 in. above the top of the casing. The gas increased as the well was bored deeper, and at a depth of about 1,300 ft. it burned with a flame about 7 ft. above the top of the casing. This well is 10 in. for the first 500 ft., then it was reduced to 8 in."



## YOLO COUNTY.

*Capay Valley.*—Inflammable gas is said to have been discovered arising from a saline spring on the Evarts ranch.

## PETROLEUM.

California now takes the place of fourth in rank among the States in the production of petroleum, and a careful review of the subject shows that petroleum is assuming an increased importance among the mineral resources of our State. The petroleum industry has already assumed large proportions in Los Angeles and Ventura counties, and it is prosecuted to a less extent in Santa Clara, Kern, and other counties. The recent discovery of new valuable oil territory in the city of Los Angeles has given a decided impetus to the business, and it is probable that careful and systematic investigation will make known other localities where oil may be obtained in valuable quantities.

## FRESNO COUNTY.

There are two groups of oil claims in Fresno County. The first of these is about 3 miles W. from Coalinga, and the second is nearly 9 miles N. from the same village.

*First Group.*—In those claims nearest Coalinga there are practically no developments; the geological formation consists of Cretaceous rocks—in which the coal mines of Coalinga are situated—overlaid, in places, by Tertiary strata, which also constitute the first tier of foothills.

*Second Group.*—The claims here cover an area of about 12 square miles. Two oil-bearing formations are exposed, namely: a light-colored silicious shale, belonging to the Miocene group, which yields an oil of high specific gravity; and dark-colored shales and soft sandstone, belonging to the Cretaceous system, from which an oil of low specific gravity is obtained. Five wells have been bored in the latter formation, and their depth varies from 163 to 650 ft.; three of them have been plugged. One of the open wells yields a small stream of weak brine and a little oil and gas. In the other an oil of low specific gravity stands within 32 ft. of the surface, and inflammable gas bubbles freely through the oil. Opinions differ as to the results attained by boring these wells. It is said that from one of them 10 bbls. of oil was pumped daily for two days, and that on the third day it yielded 7 bbls. of oil. Also that one of the wells, which is a 4 in. well and 400 ft. deep, yielded 9 bbls. of oil daily.

Samples of oil from this district were examined in the laboratory of the Mining Bureau, with the following results:

*Oil from a Spring in the Light-colored Shales.*

	Specific Gravity.
Crude oil.....	.988 about 12° B.
Below a temperature of 200° Centigrade a small amount of oil came over with water.	
Distillate below 250° Centigrade, 2.30 per cent.	
Distillate below 320° Centigrade, 6.20 per cent.....	.961 about 16° B.

*Oil from a Well in the Dark-Colored Shales.*

	Specific Gravity.
Crude oil .....	.852 about 34° B.
Distillate below 110° Centigrade, 0.60 per cent.	
Distillate below 150° Centigrade, 32.00 per cent. ....	.799 about 45° B.
Distillate below 200° Centigrade, 27.60 per cent. ....	.833 about 38° B.
Distillate below 250° Centigrade, 16.60 per cent. ....	.875 about 30° B.
Distillate below 320° Centigrade, 12.00 per cent. ....	.911 about 24° B.

The well from which this sample of oil was taken penetrates Cretaceous formations.

## KERN COUNTY.

The principal oil-bearing formations are in the foothills of the Coast Range, in Buena Vista and Sunset oil districts.

*Buena Vista Oil Company.*—This company owns some 720 acres and have sunk four wells on their property, three being 92, 202, and 410 ft. deep. It is stated that the 92 ft. well yields 3 bbls. of heavy oil daily by bailing; also, that when the deepest well was only 392 ft. down 22 bbls. of heavy oil were pumped from it daily; but that when the casing was lowered to a greater depth the oil was shut off.

*Sunset Oil Wells.*—Here are two groups of oil wells; the *first* of these pierce a formation which is principally composed of light-colored silicious shale, and the *second* penetrate strata in which sandstone predominates.

In the *first group* there are twelve wells, varying from 80 to 500 ft. in depth, which yield altogether about 15 bbls. of heavy oil per day by pumping. The heavy oil is treated in a small refinery which has been erected at these wells by Messrs. Jewett & Blodget. The products of this refinery are heavy distillates and refined asphaltum, the latter being the residue from the process of distillation.

In the *second group* there are three wells. The first well bored is 820 ft. deep, and 6 bbls. of oil and 100 bbls. of brine are said to have been pumped from it daily for six months. The second well is of similar depth and yielded 4 bbls. of oil and 150 bbls. of sulphuretted brine daily. The third well is 1,320 ft. deep, and is said to yield more oil and brine than the other wells. A sample of the brine from this well was examined in the laboratory of the Mining Bureau, and found to contain 139 grammes of solid matter to the gallon, 118 grammes of which were sodium chloride (common salt) and 0.075 gramme iodine. The presence of an unusually large amount of iodine appears to be a characteristic feature of water from the oil-bearing formations on the eastern side of the Coast Range.

There are other wells in the Sunset Oil District which yield brine and a small amount of oil, but they have been abandoned. Nearly all of the oil wells in the Sunset District yield inflammable gas.

Samples of oil from the Sunset Oil District were examined in the laboratory of the Mining Bureau, and they showed as follows:

*Sample of Oil from Oil Well No. 3, Group 2, Sec. 28.*

	Specific Gravity.
Crude oil .....	.956 about 17° B.
Distillate below 250° Centigrade, 0.60 per cent.	
Distillate below 320° Centigrade, 48.33 per cent. ....	.876 about 30° B.

*Sample of Oil from Oil Wells, Group 1.*

	Specific Gravity.
Crude oil (maltha) .....	1.01 about 10° B.
Distillate below 250° Centigrade, 0.60 per cent.	
Distillate below 320° Centigrade, 40.00 per cent. ....	.881 about 29° B.

This sample was obtained from a tank which was said to be filled with a mixture of oils from Oil Wells, Group 1.

*Sample of Oil from Well near Flowing Well, Sec. 13, T. 11 N., R. 24 W., M. D. M.*

	Specific Gravity.
Crude oil .....	.966 about 15° B.
Distillate below 200° Centigrade, 0.60 per cent .....	.840 about 37° B.
Distillate below 250° Centigrade, 5.00 per cent .....	.845 about 36° B.
Distillate below 300° Centigrade, 8.60 per cent .....	.870 about 31° B.
Distillate below 320° Centigrade, 5.20 per cent .....	.875 about 30° B.

More details concerning the occurrence of oil in this county will be found in Bulletin No. 3 of this Bureau, on "The Gas and Petroleum Yielding Formations of the Central Valley of California."

#### LOS ANGELES COUNTY.

The oil field lying E. of Newhall has been exhaustively described in our Xth Report, p. 283. Subsequent developments E. of Newhall and elsewhere about the region are of such a character as to indicate that the oil field is of much greater extent than was formerly believed. Indeed, it would seem strange if the narrow confines of Pico and Tousley cañons, with their folded and fractured strata, embraced all the oil-bearing formation in this portion of the State. Oil is being pumped from wells 10 miles E. from Pico Cañon, in Ventura County; in the city of Los Angeles; Puente, 20 miles E. of Los Angeles, and the indications are that a very extensive oil field has been penetrated in a few places. The Santa Clara Valley, north of Pico Cañon, and the San Bernardino Valley, south, each offer opportunities to those having capital and confidence in such an enterprise as sinking wells for oil in an untried field. There are thirty-seven wells in the Pico and Tousley districts, which are producing large quantities of oil. The actual production is not made public. The Tertiary formations in which the oil occurs has an extensive development in this part of the State, and it is reasonable to presume that oil may be found in paying quantities in the valleys above mentioned and also on the south side of the San Gabriel Valley, between Pasadena and Puente.

*Banner Oil Well.*—It is in Mud Springs Cañon, E. of the Golden West. This well is 800 ft. deep. When the well was first bored it yielded 125 bbls. of oil in eight hours, but water and quicksands broke into the well and ruined it.

*Bayer & Bentz Well.*—This is on Toluca Street, a short distance W. of the Thomas Wells. This is a 9½ in. well, and is 1,000 ft. deep, and yields 25 bbls. of oil daily by pumping. The formation penetrated by the Los Angeles wells is said to be a sandy shale, traversed by thin strata of sand and a few "shells" of silicious or calcareous rock.

*Doheny Wells.*—They are on Douglas Avenue, between West State and Court Streets. Six of these are 6 in. wells and about 600 ft. deep. About 10 bbls. of oil are pumped from each of these wells daily. The Doheny Company also own four 9 in. wells, which vary from 250 to 400 ft. in depth. These four wells yield about 10 bbls. of oil daily.

*Ellsworth & Griggs Wells.*—There are four of them E. of the Doheny Company. Three of them are 10 in. wells, 500, 700, and 675 ft. deep, yielding 25 bbls. of oil daily by pumping. The other well is 8 in. and was 675 ft. deep in July, 1894; it was then being bored to a greater depth.

*Golden West Oil Well.*—It is in Mud Springs Cañon, about 2 miles E. of Newhall. This well is 930 ft. deep. Oil was struck at a depth of 910



ft., but although there was a good showing of oil, it could not be profitably pumped on account of quicksand.

*Los Angeles Oil Wells.*—For many years a small deposit of brea was known to exist on West State Street, near Douglas Street, in the city of Los Angeles; and the brea was used locally for fuel. In 1892, at the corner of Paton and State Streets, not far from the deposit of brea before mentioned, a shaft 4 by 6 ft. and 155 ft. deep was sunk. The formation penetrated was sandy shale, with a few thin strata of sand and hard silicious rock. Near the surface the oil was a maltha, but at a depth of about 7 ft. the oil was lighter and seeped from the sides of the shaft. The most oil exuded from the most porous material, and it flowed readily from the surface planes of the hard silicious strata. The formation dipped S. 40°. At a depth of 155 ft. so much gas was encountered that further excavation was prevented. An 18 in. hole was then drilled in the bottom of the shaft and yielded 7 bbls. of oil daily for several weeks; in July, 1894, the yield had decreased to 2 bbls. of oil a day. In November, 1892, the first oil well was sunk at Los Angeles, on the north side of West State Street, between Paton and Douglas Streets.

C. E. Shaw, chemist to the Turner Oil Company, states that the oil yielded by the Los Angeles wells is a natural lubricating oil of a dark green color, and that an analysis of an average sample shows as follows:

	Per Cent.
First distillate, 48° to 26° B.....	25.0
Lubricating oil, 26° to 18° B.....	62.5
Asphaltic residue.....	12.5
Total.....	100.0

*Pico Oil Wells.*—They are in Pico Cañon, all within a distance of about 7 miles of Newhall, on the S. P. R. R., and are situated as follows: In Pico Cañon there are thirty-six producing wells, which vary from 600 to 735 ft. in depth. In Wiley Cañon there is a 600 ft. well, and in Elsmere Cañon there is a 600 ft. well. The oil yielded by this group of wells is conveyed by a pipe-line to Newhall. About 40 men are employed at the Pico Oil Wells. See our VIIth Report, p. 39; also Xth Report, p. 283.

*Puente Oil Wells.*—These are about 20 miles E. of Los Angeles. There are twenty-five producing wells, which vary in depth from 1,000 to 1,200 ft. The oil is conveyed by a pipe-line, 6 miles in length, from the oil wells to Puente, on the S. P. R. R. In July, 1894, the Puente Oil Company were laying a pipe-line between their oil wells and Los Angeles.

*San Bernardino Oil Well.*—This is in Placerita Cañon, 4 miles from Newhall. This well is 640 ft. deep; a set of tools was lost in it.

*Thomas Wells.*—These two wells are a short distance S.E. of the Doheny Company. Some of the wells are 6 in. and others 8 in.; they vary from 475 to 625 ft. in depth. The principal oil-bearing stratum is struck at a depth of about 600 feet, or at a somewhat less depth in the most western of these wells. About 50 bbls. of oil are pumped from these wells daily.

*Washington Oil Wells.*—They are in Tousley Cañon, about 3½ miles W. of Newhall. The oil territory owned by this company embraces about 1,000 acres. In July, 1894, the Washington Oil Company had two wells, 200 and 400 ft. deep, producing a black oil, and were boring a well which was then about 600 ft. in depth. It is said that a dark green oil was struck in the last-mentioned well. Six men are employed.

## MONTEREY COUNTY.

*Cholame Valley Oil Company's Well.*—The well sunk by this company 2 miles N.E. of Parkfield was not a success. The strata passed through were unaltered sandstones to a depth of 800 ft. Just above the well are several small tar springs, issuing from soft sandstones. The well was bored in a little valley 400 ft. above the main Cholame Valley, at the base of Table Mountain. It is probable that the sandstones are not much disturbed, and the fact that tar seeps out of the side of the mountain was not a sufficient reason for boring a well at that point. It was very doubtful whether oil exists in paying quantities in this part of Cholame Valley. This section is described in our VIIth Report, p. 87.

## SAN BENITO COUNTY.

*San Carlos Oil Company's Well.*—Nothing has been done here since our XIth Report was published. The oil well of this company is situated in the center of what appears to be a promising field. Oil-bearing shales and sandstones extend for nearly 10 miles along the southeast side of Vallecitos Valley, and over the divide toward Grizzly Cañon. Seven wells have been sunk along this belt, but with one exception they are very shallow, and though the indications are good, nothing is being produced at present. Seepages of oil, it is said, were found in all of them. The San Carlos well reached a depth of 160 ft., and from all that can be learned a considerable amount of oil was found here, but for some unknown reason the company is letting it lie idle. The formation is probably Miocene, lying quite flat in the valley, where it consists of blue clay rich in gypsum, while on the south and west and lower in the series there are bituminous shales and soft, porous sandstones, dipping away from the higher ridge of older rocks at a high angle or folded against it. Small tar springs are to be found in several places. It is definitely known that oil of an excellent quality exists here, and what is needed now are several test wells which would demonstrate whether it is present in paying quantities. Vallecitos District was described in our XIth Report, p. 372.

## SAN LUIS OBISPO COUNTY.

*Abandoned Well.*—Six miles east of Cambria, on the western slope of the Santa Lucia Mountains, an oil well has recently been put down to a depth of nearly 700 ft. Nothing was found and the well was abandoned. A poorer place for an oil well could hardly have been selected, and though the formation through which the well was bored is the oil-bearing one in Southern California, yet it seems that no examination was made of the structure and extent of the formation. The Tertiary in this section, consisting of sandstones and light-colored bituminous slates, lies along the western slope of the Santa Lucia Mountains, in a long, narrow arm partly folded in between ridges of the older rocks, and at the point where the well was bored is quite narrow. It is broken up by several dikes, which extend in a parallel direction for several miles. It was apparent that in the course of only a few hundred feet the basement rocks must be struck, which it seems was the fact. At the point at which drilling ceased basic crystalline rock was met, one similar to that projecting through the strata on the surface.

## SANTA BARBARA COUNTY.

*Occidental Company's Wells.*—The wells belonging to this company are 7 miles E. of Santa Barbara, on the southern slope of the Santa Ynez Mountains. Five wells have been bored, of which three are dry. No. 1 has produced 5,000 bbls. of heavy oil; at present it is producing  $2\frac{1}{2}$  bbls. daily. No. 2 was bored 625 ft.; dry. No. 3, abandoned. No. 4, down 425 ft.; abandoned. No. 5, 285 ft. deep; has produced about 500 bbls. of oil. The formation dips into the range at a high angle, forming, with a reversed dip higher up, a sort of synclinal. Numerous tar springs are found in the vicinity. Occidental Mining and Petroleum Company, owners.

*Santa Monica Oil Company's Well.*—The well of this company is located in a cañon of the Santa Ynez Mountains, north of Carpinteria. At 400 ft. depth a little oil was struck. The well is now down 700 ft. The gas pressure is very strong, forcing a stream of sulphurous water from the well. Liquid tar seeps up through the rocks along the cañon near the well through argillaceous strata, which dip  $50^{\circ}$  to  $60^{\circ}$  S. Heavy beds of sandstone alternate with the shale.

## VENTURA COUNTY.

The petroleum interests of Ventura County are chiefly in the Santa Clara Valley.

*Union Oil Company.*—They have the most extensive business in the oil fields of Ventura County, as the following list of their various wells readily demonstrates:

	Depth.
9 wells in Santa Paula Cañon .....	150 to 800 ft.
29 wells in Adams Cañon .....	115 to 2,780 ft.
9 wells in Salt Marsh Cañon .....	500 to 1,500 ft.
5 wells in Wheeler Cañon .....	about 500 ft.
5 wells in Aliso Cañon .....	500 to 800 ft.

*In Ojai Valley.*

11 wells in Sisi District .....	90 to 900 ft.
3 wells 1 mile S. of Nordhoff .....	500 to 800 ft.

*In Sespe District.*

33 wells on Tar Creek .....	200 to 1,800 ft.
5 wells on Four Forks .....	1,500 to 1,760 ft.
7 wells in Los Angeles .....	600 to 900 ft.
6 wells in Kentuck .....	500 to 900 ft.

*In Tory Cañon.*

16 wells in Bardsdale District .....	515 to 1,745 ft.
1 well on Calagua ranch, 9 miles S. of Hueneme .....	900 ft.

From 30 to 90 men are employed by the Union Oil Company in connection with their wells, the number of employes depending upon whether boring operations are being carried on. The oil is conveyed to their refinery at Santa Paula by pipe-lines. The plant consists of numerous iron tanks, having a total capacity of about 50,000 bbls.; three 100 bbl. fire stills and one 100 bbl. steam still, with condensers; two 150 bbl. agitators; one 100 bbl. lead-lined agitator; a press-house with filtering press, and compounding-house, with suitable tanks for heating with steam and air-blast; also a large apparatus for cooling asphaltum residues and tilling barrels with asphaltum and oils; a cooper's shop, printing-ink factory, and boiler-house. From 10 to 20 men are employed in the refinery.



*Fortuna Oil Company.*—This company have six wells, varying from 115 to 450 ft. in depth, in Hopper Cañon. These wells produce about 30 bbls. of oil daily. From 5 to 8 men are employed.

*Sisi Oil Company.*—They own nine wells, varying from 320 to 800 ft. in depth, in Sisi Cañon. The yield of these wells is 1,200 bbls. a month. Ten men are employed.

*Eureka Oil Company.*—They own three wells, varying from 230 to 500 ft. in depth, in Limekiln Cañon. The yield of these wells is about 800 bbls. a month. From 2 to 3 men are employed.

*Capitol (Elysian) Oil Company.*—They own eleven producing wells, varying from 300 to 1,200 ft. in depth, which are in Sisi Cañon, and yield about 1,100 bbls. of oil a month. Also one well 1,200 ft. in depth, in Bardsdale Cañon, yielding 60 bbls. of oil a month.

## QUICKSILVER.

The total product of quicksilver in the United States from 1850 to the end of 1893 has been 1,646,537 flasks of 76½ lbs. each, net. All of this vast amount, with the exception of 65 flasks from Oregon, was produced by the mines in the State of California. The metal is found in many counties, but is now mined in Colusa, Lake, Napa, San Benito, Santa Clara, Sonoma, and Trinity. Though the annual production of the State has declined since the marked annual reduction of output of the largest producing mine—the New Almaden—the total yield is still upward of 3,000 flasks per annum. The New Almaden, which still continues to be the largest producer, though only yielding about half what it did four or five years ago, increased its yield in 1893 over that of the previous year by about one sixth. Of the total output of the State since 1850, noted above, this one mine produced 936,736 flasks.

### ALAMEDA COUNTY.

*Comstock Mines.*—These are situated in Sec. 19, T. 11 S., R. 6 E., and have not been worked for many years. The old workings consist of open cuts with short tunnels running therefrom. A large mass of silicious vein matter is exposed, which in some places shows traces of cinnabar. The foot-wall is serpentine; the hanging-wall is not visible. The altitude of the mine is about 900 ft.

*Vaughan Quicksilver Mine.*—This is in Sec. 14, T. 11 S., R. 6 E., near the contact of the serpentine and sedimentary formations. Work was commenced at this mine in 1889, when an incline 70 ft. deep was sunk upon the vein, which dips in a N.E. direction. At the bottom of the incline a 50 ft. drift has been run to the N.W., all the way in silicious vein matter showing cinnabar. At the end of the lower drift a cross-cut shows the ore body to be 18 ft. in thickness. The foot-wall is serpentine and the hanging-wall clay. At the top of the incline the ledge crops out and shows cinnabar and native quicksilver. Two tunnels have been run in to strike the vein. One of these is about 160 ft. in length, and was commenced at a point which is about 50 ft. below and 170 ft. distant in a S.E. direction from the top of the incline. The second is about 380 ft. in length, and was commenced at a point which is about 150 ft. below and 400 ft. distant in a N.W. direction from the

top of the incline. In both of these tunnels silicious vein matter, which shows cinnabar, was struck.

## COLUSA COUNTY.

*Central Mine.*—This is in the Sulphur Creek Mining District. In 1893, Mr. York, by way of experiment, concentrated some of the soft earthy ore from this mine, by washing it in sluice-boxes; he obtained about 10 tons of concentrated ore, assaying 7 per cent quicksilver. See our XIth Report, p. 185. Northey & York, of Sulphur Creek, owners.

*Elgin Mine.*—It is situated at Sulphur Creek. Development was prosecuted at this mine to some extent in 1893, and it was said that a large body of "furnace ore" was exposed; also that some rich ore was taken out and reduced in a small retort.

*Farris (Oriental) Mine.*—This is situated in the Sulphur Creek Mining District. Considerable work has been done, and about 200 tons of good furnace ore taken out. Judge Moore, of San José, owner.

*Manzanita Mine.*—This is on Sulphur Creek. During 1893-94 the work done on this mine has been principally development. The work of concentrating the low-grade ores, mentioned in our XIth Report, was suspended in 1893, owing to new machinery being required. The concentrates on hand were retorted, and the auriferous residues were saved for future treatment. See our XIth Report, pp. 184 and 185. Manzanita Gold Mining Company, of New York, owners; G. V. Northey, of Sulphur Creek, resident agent.

*Rathburn Mines.*—These mines are on "Dead Shot" ridge, which forms the western side of Bear Valley. During the winter of 1893-94 two retorts, which have a capacity of 600 lbs. every twelve hours, were in operation, and 150 flasks of quicksilver were produced. M. Rathburn states that a portion of the ore came from the Farris Mine, on Sulphur Creek. See also our XIth Report, p. 184. J. P. Rathburn et al., of Williams, owners.

*Sulphur Creek Mining District.*—The *Empire*, *Mercury*, and *Buckeye* quicksilver mines are also in this district. See our XIth Report, pp. 186 and 187.

## EL DORADO COUNTY.

*Cinnabar Mine.*—This old mine is on the East Fork of Dry Creek, 7 miles S. of Shingle Springs and 3 miles N.W. of Yeomet. The developments consist of two tunnels and a shaft. The inclosing rock is slate, talcose near the vein. Judging from specimens on the dump, the cinnabar occurs impregnating a stratum of sandstone. A furnace formerly existed here, and it is reported that quite a number of flasks of quicksilver were produced. If this is a fact, this is the only mine in the Sierra Nevada which has produced quicksilver in commercial quantities.

Cinnabar has also been found in the hills west of Big Cañon and 5 miles S. of Shingle Springs. At one spot a short tunnel was run. Particles of cinnabar are quite abundant in the creek gravels in this vicinity.

## GLENN COUNTY.

It is stated that a ledge of cinnabar-bearing rock has been discovered on the ranch of W. S. Nye, about 20 miles W. of Stony Ford.

A good "prospect" of cinnabar is also reported to have been found on the Turner ranch, about 6 miles W. of Elk Creek.

## LAKE COUNTY.

*Abbott Mine.*—It is near the Colusa County line, at the head of Grizzly Creek, 22 miles from Lower Lake, and comprises 70 acres, with 760 acres of timber land. The ore, which is found in seams, in an earthy shale, courses N. of W. near the contact with the serpentine, and carries cinnabar, black metal, marcasite, and pyrites; the "alta"\* is on the foot-wall, but the best ore is generally next to the hanging-wall. The mine is worked through tunnels, the main one, a quarter of a mile in length, runs north, cutting across to the hanging-wall, through 560 ft. of shale, striking the ore at a depth of 220 ft. below the surface. The principal ore shoot has been followed upward on a slope of about 30° for a continuous length of 600 ft. to an upper tunnel, without pinching out at either end, carrying a width of from 2 to 18 ft. of 2 per cent ore. The output with 8 men in the mine is 8 tons per day; this can be readily increased if required. On account of scarcity of timber, which costs 7 cents per foot, lagging 7 cents apiece, the ground is secured by filling the stopes with waste, and recovering the stulls for further use. There is a Knox & Osborne coarse-ore furnace of 10 tons capacity, with 6 small-sized iron condensers, and a blower run by a 20 ft. overshot wheel, which takes its water from the mine. The lime used is burnt on the ground. See our XIth Report, p. 239.

*American Mine.*—This is 7 miles W. of Middletown, on the same range as the Great Western. Here the cinnabar is found in the seams and in bunches in a silicious rock. Wright Bros., of Middletown, owners.

*Baker Mine.*—It is in Sec. 16, T. 12 N., R. 6 W., 5 miles E. of Lower Lake, and comprises 40 acres. The ore body has the same course as the Knoxville and Manhattan, between sandstone and serpentine, the former being the hanging-wall, and the "alta" forming on the serpentine. Cinnabar with some cinnabarite and marcasite is found next to and also in the sandstone. The outcrop is indicated by a series of mineral springs; one of these is a boiling, the others cold soda and chalybeate springs. There are two seams pitching at an angle of 30°. The ore is reported as yielding 0.75 per cent of metal; the marcasite is slightly auriferous. Developments consist of a 700 ft. tunnel driven on the ore body, besides a 100 ft. shaft with a 40 ft. drift running to the under seam and beyond, but not reaching the upper seam. See our XIth Report, p. 66. J. C. Baker, of Lower Lake, owner.

*Bullion Mine.*—It is 4 miles S.W. of Middletown, and comprises 1,500 by 600 ft. The croppings of the ore body, 30 ft. in width, course N. 25° W., and dip about 50° S.W. Developments consist of a 60 ft. shaft and cross-cuts run to the fissures from the bottom, about 20 ft. long. A small retort is used for prospecting.

\* "Alta" (a Spanish term) is a layer of attrition products, so-called clays, full of slickensides and of fragments of rocks more or less rounded by attrition; it is followed by the miners in their search for ore.—Becker.



*Destinelle Mine.*—It is an east extension of the Abbott, and comprises three claims extending into Colusa County. Developments consist of four tunnels. See our XIth Report, p. 239.

*Great Western Mine.*—It is 4 miles S.W. of Middletown, and comprises 6,000 by 600 ft. The ore body ranges nearly E. and W., with a curving dip first to the N. for a depth of 350 ft., then S. The ore body consists of masses of ore extending from the black hanging-wall to the sandstone foot-wall, the latter becoming highly metamorphosed in depth to an extremely hard quartzite. The hanging-wall gradually approaches the foot-wall, pinching the ore, which, however, forms again behind. Black opaline rocks form the croppings. The cinnabar is found next to the sandstone, and in some parts of the mine there is native mercury. The workings are carried on through a double-compartment shaft 350 ft. deep, from which a drift 800 ft. connects with a second shaft, where the hoisting is done by compressed air. The ore is hoisted through the shafts, while the waste is trammed through a tunnel 500 ft. below the collar of the shaft. On account of the heavy pressure of the ground, the working drifts are run in the foot-wall parallel to the ore deposit, as otherwise connections could not be maintained. The stopes, which are from 15 to 200 ft. wide, are timbered with extremely heavy square sets (2 to 3 ft. timbers), as used on the Comstock, and these are frequently crushed. In some of the hot stopes stalactites of iron sulphate form. The ore averages 0.75 per cent of metal, and the present output is 70 tons per day. There are two furnaces, for coarse and fine ore, which consume 10 cords of wood per day, costing \$3 25 per cord. The yield for 1893 was 3,250 flasks, as against 6,000 flasks the previous year, the decrease being due to the hot, bad air in the stopes. See our VIIIth Report, p. 325; also XIth Report, p. 64. Great Western Quicksilver Mining Company, owners; A. Rocca, of Calistoga, Superintendent.

*Standard (Mirabel) Mine.*—This is 13 miles N. of Calistoga, in part of Secs. 14, 23, 22, 26, 27, T. 10 N., R. 7 W., and comprises 1,200 acres. The course of the ore deposit is to the N.W., with a dip of 40° E., and is in the nature of a fissure or pipe vein, between serpentine and sandstone, with "alta" on the hanging-wall. The two veins on the surface unite at 300 ft. in depth. The ore is opaline, carrying cinnabar and free mercury. Developments are carried on in the mine through a double-compartment shaft 400 ft. deep, with drifts every 100 ft., extending out 400 ft. from the shaft. A stope on the 300 ft. level is 250 ft. long, 50 to 60 ft. wide, and timbered with square sets. The pay shoot has been drifted on 600 ft. Two furnaces are employed; the coarse-ore furnace has a capacity of 15 tons per day, and the fine-ore of 30 tons; the ore averaging  $1\frac{3}{4}$  per cent of metal. Last year's output was 5,151 flasks. Timbers cost \$16 per thousand feet, board measure. Freight is \$6 per ton, and wages \$2 per day. Present force is 50 men. See our XIth Report (Bradford Mine), p. 64. Standard Quicksilver Mining Company, owners; —Randol, of Middletown, Superintendent.

*Sulphur Banks Mine.*—This is on the southeastern end of Clear Lake, and comprises 40 acres, besides some land near Burns Valley, where the company have two limekilns. The old works have been abandoned and a prospect shaft has been sunk 149 ft. in new ground, and is supplied with steam hoisting works, large blowers, and a No. 5 Hooker pump. The water hoisted from the shaft has a temperature of 135° F. The furnaces are not working; five retorts are used cleaning up. Fifteen men

are employed. See our VIIth Report, p. 324. Sulphur Banks Quicksilver Mining Company, owners; R. White, of Lower Lake, Superintendent.

*Uncle Sam Mine.*—It is 10 miles N.W. of Lower Lake, near Konocti Mountain, and comprises three claims. It is a mere prospect; the indications show low-grade ore, and extend over a width of about 400 ft. in serpentine. A. A. Gibson, of Lower Lake, owner.

*Utopia Mine (Quicksilver).*—This is on the east side of Clear Lake, opposite Lakeport, near Bartlett Landing, and comprises one claim; it is undeveloped. L. Boggs, of Lakeport, owner.

*Wall Street (Jewess) Mine.*—It is 6 miles W. of Middletown. Not working. The opaline rock carries cinnabar and native mercury.

#### MONTEREY COUNTY.

*Murray Quicksilver Mine.*—It is on one of the northern branches of San Carpojoro Creek, about 2 miles from the ocean. A small furnace was erected here and some quicksilver produced, but work has ceased.

#### NAPA COUNTY.

*Etna Mine.*—This is in Secs. 2, 3, and 4, T. 9 N., R. 6 W., 1 mile N. from Lidell, at an altitude of 1,200 ft. It comprises the Old Phoenix Mine, Washington, Silver Bow, Red Hill, Pope, and Star claims. The rock which carries the ore in the Phoenix is a black chalcedony and silicious slate, through which run stringers of cinnabar. The ore occurs in a fissure system, but with some impregnations in places. Most of the present developments are being made in the Star, Silver Bow, and Red Hill ground. In connection with the cinnabar are marcasite, pyrite, native mercury, and a peculiar bituminous substance named by Dr. Becker "napalite." In his monograph, "Geology of the Quicksilver Deposits of the Pacific Slope," he gives the following analyses made on three samples:

	Carbon.	Hydrogen.
Pure material from rock samples .....	89.84	10.17
Material dissolved in ether, filtered .....	89.54	10.36
Material fused at low temperature .....	89.35	10.11

In the Star and Silver Bow claims the ore occurs at the contact of basalt with the sandstone which it penetrates. In the Pope claim the cinnabar is found in a silicious shale.

This mine is at the S.E. end of a belt of serpentine extending N.W. for several miles, in which several other prominent quicksilver mines are located. The main workings are through a tunnel running in through serpentine and sandstone, to a body of argillite that crops out on the top of one of the hills; this tunnel is nearly three fourths of a mile long and 350 ft. below the surface. Two other tunnels are also being run. That on the Star claim is about 200 ft. deeper than the main tunnel (1,300 ft. long) and is run to cut a large chamber of ore in the Silver Bow claim. The third tunnel, running toward the argillite point, is 138 ft. lower than the main tunnel. The average cost for driving ground in these tunnels is about \$2 25 per foot. In No. 2 tunnel the walls are slow swelling, but on the whole the mine does not require heavy timbering. The largest part of the present ore supply

comes from east of the main tunnel at the contact of the sandstone and argillite, the ore impregnating the sandstone. The mine has natural ventilation. The ore is taken from the mine by mule power, hauling four cars at a time, making nine trips per day.

Two furnaces are working, one on coarse and the other on fine ore. The former has a capacity of  $22\frac{1}{2}$  tons, the latter  $15\frac{1}{2}$  tons per day, giving a yield of 320 flasks per month, with a consumption of 2,500 cords of wood per year, costing \$4 per cord, delivered. A National compressor runs a Phoenix National and an Ingersoll drill. Timbers cost  $5\frac{1}{2}$  cents per foot; freight, \$4 per ton. About 100 men are employed, the majority Chinese. Whites receive \$2 and Chinese \$1 25 per day. See our XIth Report, p. 72. Aetna Mining Company, owners; B. M. Newcomb, of Lidell, Superintendent.

*Harrison Mine.*—It is in Sec. 36, T. 12 N., R. 5 W., 17 miles S.E. of Lower Lake, between the Manhattan Mine and Lower Lake, and comprises 40 acres. Two men are running a tunnel to the ore seam, now 300 ft. in and about 200 ft. below the surface. E. Harrison et al., of Knoxville P. O., owners.

*Knoxville (Redington) Mine.*—This is 20 miles W. of Capay Valley, at Brooks Station, in Secs. 5 and 6, T. 11 N., R. 4 W. The mine is on the range dividing Yolo and Napa counties, and comprises 160 acres of mineral land; the entire property includes several thousand acres. The ore body courses N.W., dipping  $45^{\circ}$  N.E., between serpentine and sandstone walls, the latter on the east. The width of the vein is from a seam to 75 ft.; in the present workings the ore body is from 15 to 20 ft. wide.

The old works, which extended to a depth of 600 ft., are closed for the present, and work is being carried on to the N.W., where a double-compartment shaft supplied with a steam hoist has been sunk 200 ft. The water is hoisted by a bucket. A tunnel from the surface connects with this shaft, also with the old workings. The mine is well ventilated. The ground is swelling; in the main drift and tunnel 7 ft. posts are used with caps  $3\frac{1}{2}$  ft. in the clear and 7 ft. spread. Posts and caps are used in the stopes, and the waste rock is filled in. The mine timbers are bought here by the cord, 100 cords of the timber being used per annum at \$7 per cord; it has to be hauled from 3 to 10 miles. The Livermore patent fine-ore furnace consumes  $1\frac{1}{2}$  cords of firewood per day, at a cost of \$5 per cord; the output is 25 tons per day of 0.75 per cent ore; 19 condensers are used. The output of quicksilver last year was 1,450 flasks. At the present time 35 men are employed, all white, who receive \$40 and board per month. From the present working shaft a cross-cut extends 170 ft. to the ore body, there being two parallel seams 55 ft. apart pitching about the same ( $40^{\circ}$ ), but getting somewhat flatter in depth. The drift extends N. and S. on the seams, 150 ft. on the front and 175 ft. on the back seam. From the drift a winze has been sunk to the 300 ft. level, where there is a fine showing of first-class ore against the clay seam. A. McMillan, of Knoxville P. O., owner.

*Lake (Manhattan) Mine.*—This is 3 miles W. of Knoxville and 17 miles S.E. from Lower Lake, in T. 10 N., R. 4 W., and comprises fifteen claims. The ore belt has the same N.W. course as the Knoxville. The old works, 200 ft. deep, are not being worked; the present workings are carried on through a shaft 200 ft. deep sunk in the sandstone W. of the former works, with two levels 100 ft. apart, cross-cutting 170 ft. to the



ore seam. A stope 170 ft. long carries ore from 30 to 40 ft. wide, the cinnabar being in seams as well as impregnating the sandstone. There is no swelling ground in this mine, and ventilation is secured through an air shaft 150 ft. deep connecting with the drifts, the main shaft being an upcast. Two furnaces are used alternately, one for the coarse, and the other for the fine ore. None of the ore is crushed; all that passes through the grizzly goes through the fine-ore furnace, the rest to the coarse-ore furnace, which is started when sufficient material has accumulated. The output of these furnaces is 24 tons per day for the coarse furnace and 20 tons for the fine. Last year the furnaces ran three months, producing 400 flasks. The ore averages 1 per cent of mercury. The coarse-ore furnace consumes  $1\frac{1}{2}$  cords per day, costing \$5 per cord, obtained from a distance of from 6 to 10 miles. Freight charges are  $\frac{3}{4}$  cent per pound for three months and  $\frac{1}{2}$  cent for nine months. Lumber delivered from Lower Lake costs \$28. Thirty-one men are employed, miners receiving \$39 and laborers \$30 per month (26 days) and board. The present output is given as 15 to 20 flasks per month. The sulphurets in this mine carry a little gold. The mine has produced 5,000 flasks. Lake Mining Company, owners; R. F. Knox, of San Francisco, Secretary.

*Manhattan Mine.*—See Lake.

*Napa (Oat Hill) Consolidated Mine.*—See our XIth Report, p. 65. It is 4 miles N. of Lidell, at the head of Pope Valley on James Creek, at an elevation of 2,000 ft., and comprises eighteen patented and four possessory claims. The present developments are all to the west of the former works, in a friable sandstone, and include thirteen tunnels driven on different contour levels; five of these are being worked. There are three tunnels on No. 1 contour level; three on No. 2; four on No. 3; one on No. 4. The Humboldt tunnel on No. 1 contour is 1,128 ft. long, of which the first 100 ft. are cross-cutting to seam No. 1; 400 ft. beyond is a second seam; the third seam is found 137 ft. farther, and a fourth one 850 ft. from the mouth of the tunnel. The Edna Maybell tunnel on No. 1 contour is 1,550 ft. in length, and the Osceola on the same level is 300 ft. long. The seams in the first two run at right angles to the bedding planes of the sandstone, while in the Osceola the ore seams are with the bedding planes. An intermediate tunnel between contours No. 1 and No. 2 is 913 ft. long. The ore supply comes mostly from No. 2 stope in the Humboldt tunnel and from the Osceola. The daily output is 50 tons. Last year's product was 60,000 flasks. Nearly 50,000 ft. of lumber are consumed per year. A 40 ft. modern shelf furnace reduces the ore. Napa Consolidated Mining Company, owners; B. M. Newcomb, of Lidell, Superintendent.

*Oakville Mine.*—It is  $1\frac{1}{2}$  miles S. from Rutherford, on the range of mountains forming the western boundary of Napa Valley. It contains an old furnace plant. The formation is silicious slate with serpentine in close proximity; the outcrop can be traced for nearly two miles in a N.W. and S.E. course, dipping W.; the ore carries cinnabar, with pyrite and calcite, forming in seams and benches connected by narrow stringers of ore. It is developed through several tunnels partly caved. Cross-cutting from the N. to the vein, considerable water was tapped, which still issues from the tunnels. The mine, though idle now, has yielded considerable quicksilver, and would pay to work whenever the price of quicksilver goes up. Oakville Mining Company, owners; — Jenkins, of Oakville, agent.

*Oat Hill Mine.*—See Napa Consolidated.

*Old Phoenix Mine.*—See Ætna.

*Pope Mine.*—See Ætna.

*Redington Mine.*—See Knoxville.

*Red Hill Mine.*—See Ætna.

*Silver Bow Mine.*—See Ætna.

*Summit Mine.*—It is 8 miles S. from St. Helena and 4 miles W. from Rutherford, near the Napa Valley Railroad, in Sec. 24, T. 6 N., R. 6 W., at the head of Dry Creek, and comprises 80 acres. The ore body outcrops plainly for 2,000 ft., about 60 ft. wide, coursing N.W. and S.E., and pitching about 70° E., between serpentine on the W. and sandstone on the E., with "alta" next to the hanging-wall, 10 to 12 ft. thick. The ore body shows calcite, silica, and cinnabar, with chromium stains. A part of the outcrop has been quarried, yielding ochery ore, said to have returned, after sorting, 9 per cent of metal. A tunnel cross-cutting through the serpentine for a point beneath the former surface workings has reached 250 ft., or about half the required distance; it is expected to reach the ore body about 300 ft. below the surface. Little timbering is required, and two men make 3½ ft. per day at wages of \$1 and board; four men are employed. Timber is procured about 1½ miles away; fir being used. Cordwood, cut on the ground, costs \$3 delivered. F. W. Keeny, of Rutherford P. O., Napa County, owner.

*Washington Mine.*—See Ætna.

#### SAN BENITO COUNTY.

These mines, in the northeast corner of the county, have not been worked for many years.

*China Diggings.*—These are situated upon the county line, in Sec. 20, T. 11 S., R. 7 E. On them are open cuts filled with talus from the Mariposa Peaks. The formation appears to be decomposed eruptive rock, permeated with silicious veinlets, some of which show traces of cinnabar. Altitude, about 2,300 ft. See our VIIIth, Xth, and XIth Reports, pp. 486, 515, and 371.

*Mariposa Claim.*—This crosses the southeastern extremity of the Santa Cruz claim, with which it conflicts on the surface. About 400 ft. N.E. of the principal workings of the Santa Cruz, and probably 100 ft. below them, a tunnel has been run 200 ft. into the mountain in a N.E. direction. In the end of the tunnel, and in a short drift at this point, there are numerous narrow seams of cinnabar mixed with material which resembles the wall rock. These seams dip S.W. The inclosing formation is a soft, white eruptive rock. See our VIIIth, Xth, and XIth Reports, pp. 486, 515, and 371.

*New Idria Quicksilver Mines.*—They have been thoroughly described in our VIIIth and XIth Reports, pp. 483 and 373. No new developments since. Thomas N. Williams, of New Idria, Superintendent.

*San Benito Mining Company.*—This company is operating on the Gypsy claim, near Staytonville, 15 miles N.E. of Hollister. A tunnel is being run to tap the ledge 200 ft. below the surface. The summit of the range on which the Staytonville mines occur is formed chiefly of a quartz-trachyte. The veins course N. and have a vertical position in the lava. Developments in this district have shown that the veins are small and are not generally profitable to work. See our Xth Report, p. 516. — Nikerson, of Hollister, Superintendent.

*Santa Cruz Mine.*—This adjoins the China Diggings on the east, in the same formation. In December, 1893, there was a small quantity of cinnabar ore on the dump. See our VIIIth, Xth, and XIth Reports, pp. 486, 515, and 371.

SAN FRANCISCO COUNTY.

In the early part of 1893, in excavating on the S.W. corner of McAllister and Devisadero Streets, cinnabar was discovered by the workmen. A shaft was sunk 18 ft. and several shallow trenches dug; the result was about 350 pounds of high-grade ore and a considerable quantity of low-grade material. Believing that the prospect would lead to nothing more valuable, mining operations were suspended. An examination of the locality proved the occurrence of the cinnabar at and near the contact of sandstone and serpentine. A broad belt of serpentine, with numerous branches, extends S.E. from Fort Scott across the city, passing through the Presidio Reservation, Laurel Hill Cemetery, and on toward the Potrero, being exposed at numerous places, notably in the Market Street cut. It is said cinnabar was found in grading McAllister Street some time prior to the discovery above noted. None of these prospects have been followed up, however, though the mineral occurs under conditions similar to those at many of the large mines of this State.

SAN LUIS OBISPO COUNTY.

*Black Hawk Quicksilver Mine.*—It is on the south bank of the San Carpojoro Creek, 3 miles from the ocean. Several tunnels have been run here, but no extensive body of ore encountered. Small specimens have been found that are very rich.

*Oceanic Quicksilver Mine.*—See our Xth Report, p. 580. No work has been done on it for years.

*Pine Peak Quicksilver Mine.*—See our Xth Report, p. 581. It is still idle.

*Rinconada Quicksilver Mine.*—It lies just south of the Santa Margarita grant. Here are seven claims, on which appear heavy croppings of red gossan. A large amount of work has been done here, as shown by the tunnels and open cuts. Many tons of fair quality of ore lie on the dumps. See our Xth Report, p. 581.

*Santa Cruz Sunderland Quicksilver Mine.*—It is on Las Tablas Creek, 1 mile N.W. of Adelaide P. O. Many tunnels and open cuts were run on the very extensive croppings years ago. The ore is contained in a gangue of the usual kind. The deepest of the old workings was not over 60 ft. Work is now progressing on a new tunnel to cut the main ledge over 100 ft. from the surface. At the time of our visit the tunnel was in 200 ft., and no traces of cinnabar were being encountered. See our Xth Report, p. 580.

SANTA BARBARA COUNTY.

*Los Prietos and Santa Cruz Quicksilver Mines.*—They are on the Santa Ynez River, north of Santa Barbara. The Santa Cruz lies farthest up the river. The old workings are situated on the south bank at an elevation of 600 ft. above the river. The croppings of mineralized serpentine are quite extensive.

The Los Prietos Mine is 4 miles below, on a similar body of gossan,



which crops in great cliffs on the river. The old works at both places are nearly rotted down, and nothing could be found out concerning the quality of the ore. See our VIIIth and Xth Reports, pp. 537 and 596.

## SANTA CLARA COUNTY.

*Bradford & Treadwell Mine.*—It is on the east side of Silver Creek, near the North Almaden Mine. During 1893 a shaft was sunk here to a depth of 110 ft., the first 60 ft. passing through serpentine; washed gravel was then encountered, and continued to the bottom of the shaft. A drift 500 ft. in length was run east under the hill; every foot of the way was washed gravel. This unusual occurrence being deemed worthy of investigation, the writer visited the mine. A single glance at the hillside above the works served to show that a great landslide had occurred many years ago, but at a very recent geological period. An immense mass of serpentine over 1,000 ft. in length, and apparently 300 ft. wide, with a thickness of at least 60 ft., and possibly much more, had slipped down into the Silver Creek gulch, covering the deposit of gravel existing there at that time, and forcing the stream to cut a new channel farther to the west. Many detached masses of serpentine are found on the North Almaden ridge on the opposite side of the creek, which undoubtedly are due to this landslide. Further investigation showed that numerous smaller landslides had occurred along the hill in question, but none of them approaching in magnitude the one through which these miners had cut their shaft and tunnel. It may be that further prospecting on a deeper level, and at or near the contact of the sandstone and serpentine, may discover larger and more valuable deposits of cinnabar than have yet been found in this locality.

*Comstock School District.*—In the S.E. corner of Santa Clara County, quicksilver, chromic iron, antimony, and, it is said, gold have been found; but little could be learned of these occurrences, excepting that they are entirely undeveloped. This mineral section lies at the corner of Santa Clara, Merced, and San Benito counties. The region is difficult of access.

*Guadaloupe.*—See our VIIIth Report, p. 542. The mines have been idle for a number of years. Some prospecting done within the past year has resulted in the discovery of small quantities of cinnabar.

*Hillsdale Mine.*—Cinnabar occurs within half a mile of Hillsdale Station, on the Monterey branch of the S. P. R. R. Years ago the property was worked for a brief period.

*Mariposa Creek.*—Cinnabar prospects are said to occur here, but they have not been developed or even prospected.

*North Almaden.*—About 9 miles S.E. from San José are quicksilver deposits which were worked many years ago, but are now abandoned. The deposits occur in sandstone, but are small and irregular. The serpentine lies near on the E. side of Silver Creek, which appears to have cut along or near the contact of the two formations. The ruins of an old retort and furnace may still be seen near the mines.

PRODUCTION OF QUICKSILVER AT NEW ALMADEN, CALIFORNIA, FOR FORTY-ONE YEARS AND SEVEN MONTHS, FROM  
JULY, 1850, TO APRIL 30, 1894.

Date.	Class and Quantity of Ore.			Total Pounds.	Flasks from Furnaces	Flasks from Washing	Flasks--Total	Average Amount per Month--Flasks...	Percentage Yield of Quicksilver	Number of Months...
	Grueso--Pounds.	Granza--Pounds.	Tierras--Pounds.							
July, 1850, to June, 1851				4,970,717	23,875		23,875	1,989½	36.74	12
July, 1851, to June, 1852				4,643,290	19,921		19,921	1,660	32.82	12
July, 1852, to June, 1853				4,839,520	18,035		18,035	1,503	28.50	12
July, 1853, to June, 1854				7,448,000	26,325		26,325	2,193¾	27.03	12
July, 1854, to June, 1855				9,109,300	31,860		31,860	2,655	26.75	12
July, 1855, to June, 1856				10,355,200	28,083		28,083	2,340¼	20.74	12
July, 1856, to June, 1857				10,299,900	26,002		26,002	2,167	19.31	12
July, 1857, to June, 1858				10,997,170	29,347		29,347	2,445½	20.41	12
July, 1858, to Oct., 1858				3,873,085	10,588		10,588	2,647	20.91	4
Nov., 1858, to Jan., 1861				13,323,200	32,402	by imunction.	32,402	2,897	19.96	12
Feb., 1861, to Jan., 1862				15,281,400	39,262	1,129	40,391	3,366	20.22	12
Feb., 1862, to Jan., 1863				7,117,660	17,316	2,248	19,564	2,795	20.86	7
Feb., 1863, to Aug., 1863				2,346,000	4,820	700	5,520	2,760	18.00	2
Sept., 1863, to Oct., 1863				2,359,300	4,040	407	4,447	2,223½	18.65	2
Nov., 1863, to Dec., 1863	54,800	1,586,500	718,000	23,277,600	42,176	313	42,489	3,540¾	13.96	12
Jan., 1864, to Dec., 1864	1,259,400	18,730,300	3,287,900	31,948,400	47,078	116	47,194	3,933	11.30	12
Jan., 1865, to Dec., 1865	2,288,900	25,749,000	3,910,500	26,885,300	34,726	424	35,150	2,929	10.00	12
Jan., 1866, to Dec., 1866	1,506,000	19,933,100	5,440,200	26,023,933	23,990	471	24,461	2,038½	7.19	12
Jan., 1867, to Dec., 1867	731,500	15,689,288	9,603,145	26,023,933	25,577	51	25,628	2,135¾	6.66	12
Jan., 1868, to Dec., 1868	2,274,208	14,566,600	12,564,722	29,405,530	16,898		16,898	1,408	5.07	12
Jan., 1869, to Dec., 1869	150,000	11,942,175	13,366,000	25,458,175	14,423		14,423	1,202	5.23	12
Jan., 1870, to Dec., 1870	30,000	12,531,900	8,535,800	21,097,700	18,563	5	18,568	1,547½	6.44	12
Jan., 1871, to Dec., 1871		13,601,700	8,373,000	22,034,700	18,563		18,563	1,547½	6.44	12
Jan., 1872, to Dec., 1872	142,000	12,777,000	8,497,600	21,416,600	18,391	183	18,574	1,548	6.63	12
Jan., 1873, to Dec., 1873		8,492,375	8,838,000	17,330,375	11,042		11,042	920	4.87	12
Jan., 1874, to Dec., 1874		11,294,000	12,160,000	23,454,000	8,867	217	9,084	757	2.96	12
Jan., 1875, to Dec., 1875		12,236,000	18,870,200	31,106,200	13,541	107	13,648	1,137½	3.35	12
Jan., 1876, to Dec., 1876		14,784,550	18,532,400	33,316,950	20,549		20,549	1,712½	4.71	12
Jan., 1877, to Dec., 1877		13,987,700	29,243,600	37,231,300	23,996		23,996	1,999¾	4.93	12
Jan., 1878, to Dec., 1878		14,612,154	22,330,071	36,942,225	15,862		15,862	1,321	3.28	12

Jan., 1879, to Dec., 1879	16,032,085	39,033,050	55,065,135	20,514	1,709½	2.85	12
Jan., 1880, to Dec., 1880	15,267,650	46,087,200	61,354,850	23,405	1,955½	2.92	12
Jan., 1881, to Dec., 1881	14,430,510	49,710,625	64,141,135	26,060	2,171¾	3.10	12
Jan., 1882, to Dec., 1882	19,734,900	52,412,300	72,147,200	28,070	2,339	2.97	12
Jan., 1883, to Dec., 1883	21,227,500	55,935,000	77,162,500	29,000	2,416½	2.87	12
Jan., 1884, to Dec., 1884	16,410,000	62,841,000	79,251,000	20,000	1,660½	1.93	12
Jan., 1885, to Dec., 1885	17,644,300	61,425,000	79,069,300	21,400	1,783	2.07	12
Jan., 1886, to Dec., 1886	14,140,690	67,258,000	81,398,690	18,000	1,500	1.69	12
Jan., 1887, to Dec., 1887	12,648,300	51,503,000	64,151,300	20,000	1,666½	2.38	12
Jan., 1888, to Dec., 1888	11,140,600	46,185,000	57,325,600	18,000	1,500	2.40	12
Jan., 1889, to Dec., 1889	9,398,200	48,377,000	57,775,200	13,100	1,691½	1.73	12
Jan., 1890, to Dec., 1890	8,079,800	37,220,000	45,299,800	12,000	1,000	2.02	12
Jan., 1891, to Dec., 1891	5,404,706	45,764,000	51,168,700	8,200	683¾	1.22	12
Jan., 1892, to Dec., 1892	13,694,000	45,498,700	59,192,700	5,610	467½	0.72	12
Jan., 1893, to April, 1894	6,797,200	51,411,940	58,209,200	9,449	590½	1.24	16
Totals	8,436,808	424,630,837	938,932,953	920,413	8,734	1,862	4.87
			1,476,660,040	929,147			499

NOTE.—Product of Enriqueta (a body of ore separate from the main workings), from 1860 to 1863, 10,371 flasks.

Total product of all the mines on the company's property, 939,718 flasks of 76½ lbs. each, or 71,888,427 lbs., or 35,944,427 tons.

The quicksilver mines and reduction works of New Almaden are 15 miles S. of the city of San José, Santa Clara County, California, in the Santa Cruz Mountains, at an elevation of 1,700 ft. above the sea.

These mines were first worked for quicksilver in 1845, but the operations were on a small scale, and no record exists earlier than 1850. They have been the most productive quicksilver mines in the world, excepting only the mine of Almaden, in Spain. They are developed to a depth of 2,500 ft., and the workings extend horizontally over a piece of ground 1 mile square. About 350 men find steady employment, the work being actively prosecuted throughout the year. From the 1st of January, 1864, to the 30th of April, 1894, the amount of drifting and sinking in the mines of the company, as shown by the records, is 265,938 ft., or 50<sup>3</sup>/<sub>10</sub> miles, at a cost of \$2,262,011 42. This does not include the excavations made in extracting ore during the period named, nor any expense for the same, while for the ground opened up during the previous period (1850 to 1864) 15 more miles of drifting and sinking can be added.

The reduction works consist of eight furnaces, and include the most improved methods for working quicksilver ores, and may be considered as the most complete and perfect in every respect in the world.

ROBERT R. BULMORE.

NEW ALMADEN, CALIFORNIA, September 1, 1894.



*New Almaden.*—This large property has produced since 1850, during a period of 41 years and 7 months, 929,147 flasks of quicksilver, of 76½ lbs. each. The Enriqueta, also owned by the same company, produced 10,571 flasks additional. A tabulated statement of production of this famous mine has been prepared by Robert R. Bulmore, general agent of the company, covering this period, together with a short description of the mine and works, which is included in these notes. (See pp. 368, 369.)

During the past year a new shoot of ore was discovered in workings near the Santa Maria shaft, sunk for prospecting purposes only. This shoot has been followed downward and southward 200 ft. or more, and has been found to grow larger and richer as depth is attained. At this writing (March, 1894) the bottom of the stope is 20 to 30 ft. wide, 25 ft. high, and 50 ft. long. The mineral is making back into the foot-wall, and the prospect is bright for developing a large and valuable body of ore. Some of the richest ore ever obtained in the mine has recently been taken from this stope and from a point near the center of the shoot. The richest ore has usually been found heretofore on or near the hanging-wall. A brecciated condition of the rock, in which cinnabar occurs abundantly, is an interesting feature of the deposit. On the 600 ft. level one of the folds which have constituted a prominent feature of the New Almaden Mines occurs. A drift is being run from the Harry shaft, on the 700 ft. level, to cut under this fold, to determine whether or not this shoot is going down. It has been stated that the occurrence of native quicksilver in these mines was looked upon as an indication of near approach to the bottom of the shoot. Particular investigation on this important matter resulted in establishing the fact that native metal occurs on the lower sides of shoots, and is not an indication of the proximity of the end of the shoot. In the shoot of ore recently discovered, for some distance the lower edge was found to be rich in native mercury. Beyond this occurrence, and 60 ft. lower, the large chamber above referred to has been opened and is producing ore as rich as has ever been taken from the mine, while no native metal is found in this portion of the deposit that may be discovered with the unaided eye. The furnaces are nearly all in operation; 170 men are employed and 25 more by contract; of these 75 are working in the mines. See our VIIIth, Xth, and XIth Reports, pp. 541, 604, 394. New Almaden Quicksilver Mining Company, owners.

*Wright Ranch.*—Two miles S. of the New Almaden Mines, cinnabar occurs in sandstone on a tributary of Los Alamitos Creek. There are several cuts and short drifts, now caved and inaccessible. The rich ore, of which there was considerable, was packed out on animals and sent to furnaces. This work was done about thirteen years ago, and accurate information is not obtainable. The workings indicate that the cinnabar was found across a width of about 40 ft. It may be considered an encouraging prospect. On this ranch are several places where the surface is deeply stained with iron oxides, but no prospecting has ever been done.

#### SISKIYOU COUNTY.

*Siskiyou Quicksilver Company's Mines.*—They are situated near the headwaters of the West Fork of Beaver Creek, 15 miles W. of Cole's Station, on the C. & O. R. R. The developments consist of several hundred feet of tunneling and other workings. The reduction plant consists of

a 10-ton furnace. Siskiyou Quicksilver Mining Company, of San Francisco, owners; Jas. McCauley, of Oak Bar, agent.

## SONOMA COUNTY.

*Black Bear Consolidated Mine.*—It is on Pine Flat, 2 miles from the Geysers, and comprises five claims on the quicksilver belt coursing W. from Mount St. Helena; between sandstone and serpentine.

*Cinnabar King Mine.*—This is in the "Pine Flat" country, a few miles from the Geysers and 22 miles N.W. from Calistoga. Six men are driving a deep tunnel to cut the ore body below the old works. The ore body is on the same mineral belt as the Ida Clayton and Yellow Jacket mines. See our XIth Report, p. 461. White Bros., of Healdsburg, owners.

*Commonwealth Consolidated Mine.*—It is 2 miles from the Geysers, and comprises three claims on a belt coursing W. from Lake County, showing a width from 20 to 80 ft., with a sandstone hanging-wall and a serpentine foot-wall. The ores are cinnabar and metacinnabarite, carrying on the pay shoot from 3 to 4 per cent of metal; the length of the pay shoot was 150 ft., with a width of 100 ft. The "alta" is found next to the hanging-wall. Developments on the mine reached a depth of 425 ft. through tunnels, and shafts below the tunnel level. There are two Knox & Osborne coarse-ore furnaces.

*Geysers I and II Mine.*—They are near the Black Bear Consolidated, and comprise two claims, on which only assessment work is done.

*Great Eastern Mine.*—See our VIIIth Report, p. 633. It is 4 miles N. of Guerneville. The Mount Jackson Mine, adjoining, has been consolidated with it. Since last reported the workings have been carried on in the upper part of the summit of the mountain in the Jackson Mine, which is the north extension. The best ore shoot is apparently near the dividing line of the two. The work is carried on through the Great Eastern shaft, extending into the Jackson ground to a depth of 220 ft. At the 140 ft. level of the Great Eastern shaft a drift 400 ft. long was driven to the ore body in the Jackson. The stopes, 40 to 50 ft. long, were worked 10 to 12 ft. wide, requiring only stull timbers. A tunnel 1,700 ft. in length, driven into the Jackson, cut the ground 150 ft. below the bottom of the shaft. The mine has been allowed to fill with water to the 150 ft. level, where it discharges through the Great Eastern tunnel, 1,000 ft. long. A compressor with two Burleigh drills is used. Last year's output was 1,400 flasks; the output at present is reported to be 120 flasks per month from one fine-ore and one coarse-ore furnace, with a capacity of 18 and 12 tons of ore, respectively, consuming  $2\frac{1}{2}$  cords of wood per day, costing \$2 25 per cord. The company own timber land, from which the redwood timbers cost, laid down, 5 cents per running foot. A. Abbey, of San Francisco, Superintendent.

*Hecla Quicksilver Mine.*—This is in Pine Flat, and comprises one claim on the same ore belt. Only assessment work is done.

## TRINITY COUNTY.

*Altoona Mine.*—It is in T. 38 N., R. 6 W., 22 miles N.E. from Trinity Center, on the headwaters of East Fork of Trinity River, and comprises 3,000 by 600 ft. The ore belt, 500 ft. wide, runs E. of S., dipping W.;

the quicksilver-bearing rock is about 12 ft. wide, having serpentine on one wall and a small belt of porphyry in immediate contact on both sides of the ore matrix. Near the surface the ore is said to carry from 3 to 4 per cent of quicksilver. The developments comprise a main tunnel 1,100 ft. long, passing through the ore body and beyond into strata of cinnabar ore on the west side; this tunnel will cut the double-compartment shaft, which is now under way, at 135 ft. depth; in future the mine will be worked through this shaft to secure dumping-ground. On account of the large drainage area, considerable water will have to be handled, for which purpose two Cornish pumps, a jackhead and a drawing pump, also a 4 in. Douglas force-pump and a No. 8 Knowles, will be put in. These and the hoist will be run by two 60 horse-power engines, while for the use of the fan and crusher a 12 horse-power auxiliary engine will be erected. Grading for a 40-ton "hard" ore furnace is being pushed ahead. Six miles of ditch conveys 80 in. of water to the mine. A sawmill is within 4 miles of the mine; timber for the present supply is at hand. Lagging costs 5 cents apiece; timbers 7 cents per ft.; freight is \$1 30 per hundred pounds from Redding. Wages are \$3 for miners and \$2 50 for laborers; \$6 a week for board; 60 men are employed. See our Xth Report, p. 716. Altoona Quicksilver Mining Company, owners; I. F. Cox, of Trinity Center, Superintendent.

*Integral Mine.*—It is 22 miles N.E. from Trinity Center, and embraces over thirty patented claims, besides timber lands, all lying between the East Fork of the North Fork of Trinity River and Crow Creek. The company employ 40 men. The ore body lies west of the Altoona, between serpentine and lime, the ore being in connection with spar and chalcodony, about 100 ft. wide. The developments comprise a shaft 230 ft. sunk on the ore body, and about 1,500 ft. of drifts running N. and S.; also a tunnel tapping the shaft at 120 ft. in depth, cross-cutting the limestone. The plant comprises a 30 horse-power hoisting engine, and a steam sawmill run by a 40 horse-power engine; also a soft ore furnace with a capacity of 20 tons per day, with 16 condensers—fourteen brick and two wooden ones. Water is obtained from Upper Crow Creek; 4 cords of wood are consumed per day; freight from Redding is \$1 35 per hundred pounds by pack-train. Forty men are employed. Integral Mining Company, owners; W. J. Simpson, of Integral, Superintendent.

## SILVER.

California has never been noted as a silver-producing State as compared with other precious-metal mining regions, yet there was a production of silver from sixteen counties last year aggregating \$537,157. Of this amount, however, \$447,020 came from the mines of Calico, San Bernardino County, which were enabled to continue working, notwithstanding the very low price of silver. Nearly all the remainder of the total was obtained in association with the gold in the ores from the gold mines. At one time—in 1884—the State produced \$3,000,000 in silver for the year, but there has been a gradual falling off. The amount produced in 1893, however, showed a decided increase over that in the previous year.



## ALPINE COUNTY.

*Polaris Group of Mines.*—There are included in this group six claims, namely: *Polaris*, *North Colorado*, *North Tarsus*, *Climax*, *Polaris Cross Claim*, and *Colorado Cross Claim*. The mines are situated in the Monitor and Mogul districts, north of the town of Monitor. They include the ground lying between the Stella and Colorado No. 2. They are developed by 1,000 ft. of tunnels and shafts. The vein on which most work has been done runs N. and S., and is small, but very rich in silver. The ore contains galena, zinc-blende, iron pyrites, and a rich silver-bearing mineral, probably stromeyerite. Cyrus Coleman, of Markleeville, owner.

## INYO COUNTY.

*Anaconda and Grand View Mines.*—They are at Panamint. The Anaconda has a vein 12 ft. wide, on which a tunnel has been run a distance of 250 ft. The vein lies in limestone and carries argentiferous copper. Death Valley Mining Company, of Riverside, owners; R. Decker, of Panamint, Superintendent.

*Consolidated Mine.*—It lies 9 miles N. of Wild Rose Springs, in the Panamint range. The vein of white quartz is  $2\frac{1}{2}$  ft. thick, and carries a free-milling silver ore, which is shipped. It is developed by drifts and open cuts. The altitude is a little over 6,000 ft. Chas. Anthony, of Darwin, owner.

*Emigrant Mine.*—It is situated 12 miles N. of Wild Rose Springs. The ore occurs in bunches and irregular vein-form in a brecciated limestone, and is decomposed and much of it free milling. It is opened by a tunnel 100 ft. long.

*Gold Hill Mines.*—They are situated 15 miles S.E. of Panamint, on the eastern slope of the Panamint range. The veins lie in limestone, and have a N.W. and S.E. direction. The ore is galena and lead carbonate, carrying silver and gold. The silver is generally in excess of the gold in value. Death Valley Mining Company, of Riverside, owners.

*North Star and Belvedere Mines.*—They are situated 9 miles N. of Wild Rose Springs, in the Panamint range. The ore from these two mines is quite similar, consisting of copper and stromeyerite in a quartz gangue. They are opened by tunnels. Charles Anthony, of Darwin, owner.

*Oroville Mine.*—It is half a mile S.E. of Panamint. On this property there are four well-defined quartz veins, carrying a low-grade ore similar to the others in this district. Developments consist of one 40 ft. shaft and 400 ft. of tunnels. The veins run a little E. of N. and W. of S., and stand very steep. — Chickering, of Panamint, owner.

*Pine Mountain Mines.*—They are on Pine Mountain, on the eastern slope of the White Mountain range. But little work has been done for some time. The deposits are developed chiefly by tunnels. A 5-stamp mill and two Frue concentrators have been placed on the property. P. W. Forbes, of Big Pine, President.

*Robert E. Lee Mine.*—It is 7 miles E. of Wild Rose Springs, on the eastern slope of the Panamint range. The ore is gray copper, carrying silver. The vein has a width of 2 ft., and can be traced the whole length of the claim. Hunagan & Rose, of Darwin, owners.

*Silver Queen Mine.*—It lies 14 miles N. of Wild Rose Springs, on the Death Valley slope of the Panamint range. The elevation is about 3,000 ft. The deposit, a quartz ledge carrying the silver-bearing metals, stromeyerite and tetrahedrite, extends N. and S., between limestone and slate. The body of ore exposed on the surface is large, but apparently lies quite flat. It is opened by an incline 110 ft. deep and by a tunnel. The ore is sorted and shipped. The developments do not show the real position of the ore body. Charles Anthony, of Darwin, owner.

*Surprise Mining and Milling Company.*—This company holds in the vicinity of the town of Panamint a number of patented claims, namely: *Hemlock, Wyoming, Ida, Hudson River, Alabama, Eureka, Independence, Little Chief, Marvel, Comstock, Stewart's Wonder, and Challenge.* The veins, lying north of the cañon in which the town is located, have a general E. and W. trend; those on the south are more irregular in direction. They are all either in limestone or at its contact with mica schist. Most of the work has been done on the steep mountain slope, 300 to 600 ft. above the town. The deepest workings are on the Hemlock, where a shaft is said to have been put down 500 ft. The veins at Panamint are well-defined quartz ledges, generally dipping at a high angle. The earliest work was done here in 1873-74-75, when a mill was erected, which was burned after having run for some time. A 10-stamp mill is on the property at present, together with a roasting furnace. The ores are not high-grade, and though far from being worked out, cannot be made profitable with the present price of silver. It is rare that any galena is found here. The ore consists of gray copper, horn-silver, and stromeyerite. P. A. Graff, 212 Tenth Avenue, New York, owner.

*Sweitzer Mine.*—It is on the eastern slope of the Inyo range, between Keynote and McAvoy cañons. It lies at an altitude of 7,000 ft. The vein is small but very rich, and is inclosed in granite. It runs N.E. and S.W., and stands nearly vertical. It is developed by a tunnel 130 ft. long and by surface work. The ore is shipped without any sorting. There is a little galena, but the richest ore is stromeyerite—a sulphide of silver and copper. James Starborough, of Lone Pine, owner.

*Virgin Mine.*—It is 3 miles N. of Wild Rose Springs, in the Panamint range, and is developed by a 40 ft. winze and numerous drifts. The gangue is a quartzose mica schist carrying tetrahedrite and antimonial ores, is inclosed in limestone, and is 40 ft. thick where the principal work has been done. The deposit can be traced for 1,000 ft. in a S.E. direction from the main workings. Chas. Anthony, of Darwin, owner.

*Wild Rose District.*—There are at least fifty other locations in this district besides those mentioned, but being idle their names and that of their owners could not be ascertained. Water is abundant at Wild Rose Springs, while 5 miles higher up on the range plenty of wood is to be found. This whole portion of the Panamint range is more or less mineralized, as shown by the numerous quartz veins and reddened outcrops. The strata are very greatly crushed and broken.

#### MONO COUNTY.

*Barasca Mine.*—This mine is situated on Blind Spring Hill, 3 miles E. of Benton. Since our last report it has been developed by 560 ft. of tunnel, and a considerable amount of stoping has been done. The



Pine City, Mono County.



Cerro Gordo, Inyo County.





tunnel has been run 150 ft. below the old one, and the ledge found to preserve the same position which it had above. As far as developed, the ore shoot has been exposed for 40 ft. with an average thickness of 1 ft. On the dip of the ledge the tunnel has tapped it 335 ft. below the old tunnel. See our VIIIth Report, pp. 379-381. John F. Millner, of Benton, owner.

*California and North Comstock Consolidated.*—This property, consisting of several claims, is situated near the head of Ferris Cañon, almost on the summit of the Sweetwater range. Here occurs a large vein carrying silver and some gold. Little more than assessment work has been done on the property. A description of these mines, as well as the others in the Patterson District, was given in our VIIIth Report, pp. 357-362. A. Solderling, of Bodie, agent.

*Comanche and Jaqui Mines.*—They are situated on Blind Spring Hill, 2½ miles E. of Benton. They were fully described in our VIIIth Report, p. 379. John F. Millner, of Benton, Superintendent.

*Cornucopia Mine.*—It is situated on the summit of Blind Spring Hill, 3 miles E. of Benton. Since our last report the following developments have been made: One branch of the tunnel has been run south on the vein 400 ft., and a shoot of ore opened for a distance of 120 ft. The ore body averages 6 to 8 in. in thickness. See our VIIIth Report, pp. 79-81. John F. Millner, of Benton, owner.

*Great Sierra Consolidated Silver Company.*—The property of this company is situated in the Tioga District, near the summit of the Sierra Nevada Mountains. Described in our VIIIth and Xth Reports, pp. 371 and 342. Great Sierra Consolidated Silver Company, 66 Broadway, New York, owners; W. P. Oukst, of Lundy, Superintendent.

*Kentucky Group of Mines.*—They lie at an elevation of nearly 10,000 ft., on the eastern slope of the Sweetwater range. The property consists of three patented claims located on a vein running N. and S. and dipping at an angle of 30° to 40° W. The inclosing rock is a compact breccia of, perhaps, volcanic origin. In years past a large amount of silver ore was taken from this mine, the work being carried to a depth of between 200 and 300 ft. At present a tunnel is being run to cut the vein 200 ft. deeper than the old workings. This tunnel has now reached a length of over 400 ft. See our VIIIth Report, p. 360. J. H. Sheehan, of Clinton, owner.

*Lady Hayes Mine.*—It is situated on the north slope of Mount Patterson, Sweetwater range. It is developed by three tunnels. See our VIIIth Report, p. 360. E. Folsom, of Pine Grove, Nevada, owner.

*Little Emily Mine.*—It is on Blind Spring Hill, 2 miles E. of Benton. The property consists of two claims, the *Eureka* and the *Laurel*. They were located in 1865, and have been worked continuously ever since. The vein is quite flat, and is known as a "blanket ledge." It has been opened from the mouth of the tunnel for a distance of over 1,000 ft., and from 400 to 600 ft. on each side of the tunnel. The ore is said to be high grade, and to vary in thickness from 1 to 2 ft. A small amount of galena is present and some gold in places. Little Emily Mining and Milling Company, of Chicago, Ill., owners; John A. Wilson, of Benton, Superintendent.

## NAPA COUNTY.

*Palisade (Grigsby) Mine.*—See our VIIIth Report, p. 413. It is  $2\frac{1}{2}$  miles N. of Calistoga, and comprises four claims, with veins running N. and S. and one N.W., and dip about  $75^{\circ}$  W., in places changing to nearly vertical.

*Silverado Mine.*—See our Xth Report, p. 363. It is on the southeast side of Mount St. Helena, in Sec. 2, T. 9 N., R. 7 W., and comprises six claims and a mill site. The vein courses N.E. and S.W., with westerly dip. Developments have been made through three tunnels, cutting the vein about 350 ft. below the highest outcrop.

## SAN BERNARDINO COUNTY.

*Calico District.*—The principal silver mining district of this county is now, and has been for many years, in the Calico range. The great depreciation in the market value of silver has had a most depressing effect on the district, but the greater part of the time the Silver King Company has kept its mines operating and the mill running night and day. The long-continued litigation between the Waterloo and the Silver King has at last terminated in a compromise, and it is understood a consolidation of interests, with W. S. Edwards, of the Silver King, as General Manager. The mines are to be reopened and the mills so long idle will again be started, and many additional men employed.

During the year ending July 1, 1894, the principal work done on the silver mines, aside from the operations of the Silver King Company, has been by chloriders, who lease certain parts of mines and have the ores crushed in custom mills. The consolidated companies now own nearly all the larger mines and are well equipped to work them, and notwithstanding the low price of silver are likely to make a large production during the years 1894-95. See our VIIIth, Xth, and XIth Reports, pp. 508, 530, and 338.

*Black Metal Mine (Silver and Copper).*—This is 50 miles S.E. of The Needles, and about 3 miles back from the Colorado River. It has long been famous owing to the high grade of ore produced. The mine has never been operated extensively, and of late years not at all. There are three well-defined veins on the property. The principal development consists of a 30 ft. shaft and an 80 ft. drift. All the rock contains chrysocolla, and in some of it horn-silver is plainly visible.

*Imperial Lode.*—This property is in the Lava Beds District, comprising a vein nearly 8,000 ft. in length. It is practically idle, nothing but assessment work being performed on any portion of it.

*Ivanpah District.*—It is almost abandoned. At one time a producer of silver ore of extreme richness, the mines are idle and the once prosperous town is deserted. See our Xth Report, p. 531.

*New York District.*—It is 10 miles S.W. of Vanderbilt; it is a silver camp and the mines are all closed down.

*Providence Mountain District.*—At one time a prominent silver-producing region, made famous by the rich ore bodies of the Bonanza King Mine, it has been practically abandoned for several years past. The discovery of gold veins in the vicinity may result in a revival of mining in the district, but at this time it is purely speculative. See our Xth Report, p. 532.



*Silver Reef District.*—It is 45 miles E. of Victor, where there are numerous claims which have not been worked at all since the depreciation in silver. Small amounts of high-grade chloride ore have been found in many places on the reef. It has been described at some length in our XIth Report, p. 365. In all probability this region will never become prominent until silver reaches a much higher figure in the market than at present.

## SHASTA COUNTY.

*Afterthought Mine.*—This patented claim is on North Creek, at the old village of Furnaceville. The property is not being worked, on account of the difficulty in handling the base ore. The former extensive works are rotting down. The mine was worked through tunnels.

*Bully Hill Mine.*—This property, comprising three patented claims, is 3 miles N. from Copper City. The ore bodies range N.E. and S.W., and carry from 15 to 18 per cent of copper, besides silver up to 40 oz. and near the surface \$2 per ton in gold.

*Extra Mine.*—This is one fourth of a mile from Copper City. The ore body follows a N.E. and S.W. course, with porphyritic walls.

*Iron Mountain Mine.*—It is 8 miles N.E. of Shasta, on Iron Mountain, and comprises 1 mile square of ground, including three claims. The course of the mineral body is N.E. and S.W., and it can be traced for over 2 miles. It is apparently the iron head or gossan caused by heavy mineral springs permeating the fissure and surrounding rocks. The mass has been cross-cut in places over 500 ft. without reaching its boundaries. As depth is reached, the ferruginous and cupriferous oxidized mass changes to massive sulphides, sometimes of a steely nature and hardness. Tunnels have been run in, on what is taken for one of the walls, a distance of 500 ft., and a series of parallel cross-cuts made every 50 ft.; some of these are several hundred feet in length, all within the ore belt. The works from the upper tunnel have been entirely honey-combed and the ore sent into the mill. Near the surface the ore carries iron, copper, silver, and gold, said to yield in the mill 40 oz. silver and \$1 gold. As depth is attained the percentage of gold increases. The reduction works include a fine 20-stamp dry-crushing mill and Bruckner furnace, 12 amalgamating pans, and 6 settlers, with a capacity of 75 tons per day. Has lately changed owners.

*Last Chance Mine.*—It is on North Cow Creek, 9 miles S. from Round Mountain. The vein courses E. and W. and dips S., between porphyry and conglomerate walls; it is 4 in. to 4 ft. wide and carries copper and lead sulphides, said to assay several hundred dollars per ton in silver, and also \$2 per ton in gold. A tunnel has been run on the vein 26 ft.

*Northern Light Mine.*—This claim, 1,500 by 600 ft., is  $1\frac{1}{2}$  miles from Copper City. The ore bodies have a N.E. and S.W. course and S.E. dip, in porphyritic country rock. No regular vein formation exists here. The minerals carried are copper, silver, and gold.

*Recorder Mine.*—This claim, 1,500 by 600 ft., is 3 miles N. from Copper City. It carries copper and silver, with a little gold, and is being prospected by the owner.

*South Fork Mining and Milling Company's Mine.*—It is 2 miles W. of Igo, and comprises eleven claims on several veins. The principal ones are the *Black Prince* and the *Black Diamond*; these course E. of N. and dip about 45° S.E. They are near the contact between the slate and

granite, with a width of over  $37\frac{1}{2}$  ft. A number of shafts have been sunk and drifted from; at present they are full of water. The highly sulphuretted ore, when sorted, is said to yield 350 oz. of silver and \$10 in gold per ton. Owned in Chicago; S. W. Robinson, of Igo, agent.

*Winthrop Mine.*—This claim is half a mile north from Copper City. The ore bodies range N.E. and S.W., between slate and porphyry. The mine is not being worked, on account of difficulty in treating the heavily sulphuretted ores, which carry iron, copper, antimony, silver, and gold.

## STRUCTURAL MATERIALS.

In structural materials, mined or quarried, California is gradually advancing. For many years little or no use was made of our natural resources in this respect, but since the era of modern buildings and improved streets and roads, the demand has encouraged owners of deposits to develop them and market the products. Naturally those having the best facilities for transportation are the first to be opened; but there are many undeveloped properties, from which an increased supply can be obtained at any time demand and prices warrant.

Portland cement has been manufactured both at Santa Cruz, Santa Cruz County, and Benicia, Solano County; but this is not now being done at either place. Some, however, is being made in Riverside County. Large quantities of cement are imported here, but so cheaply as to prevent the development of local deposits.

California clays are utilized for the manufacture of pottery, terra cotta, sewer-pipe, fire-brick, architectural work, tiles, and building-brick. These industries give employment to large numbers of men, and the annual value of the products is increasing. In numerous places throughout the State large bodies of clays and kaolins of superior quality are known to exist, awaiting the demands of commerce for their development. They are mainly found along points on the granite ranges and at points where the former drainage basin gathered the fine slickens brought from the upper ranges.

In the census year the statistics showed that California stood No. 3 among the States of the Union in the use of granite. The value of the granite produced by the quarries of California in that year—1890—was upwards of a million dollars. Last year, owing to the business depression, there was a lessened demand, and consequently a smaller production. The granite is mainly used for building and curbing purposes. That from a new quarry in San Diego County is being used on the jetty at the entrance of San Diego harbor.

Numerous quarries of rock used for macadam on roads and streets are worked in the vicinity of all centers of population where there is a demand for the material.

Many varieties of marble are found in the State, and several quarries are now being operated. The stone is now more largely used than formerly for building and cemetery purposes.

As to lime, there are kilns to be found in many counties of the State, and the total output is very large. The value of the limestone product of the State exceeds half a million dollars per annum.

The manufacture of paving blocks from "basalt" and other rocks is not so important an industry as it was before the introduction of the bituminous rock for pavements, yet there are a number of quarries still being actively operated.

Sandstone quarries are worked in several counties, and the output of stone for building purposes is extensive. The industry connected with



this stone is now quite important, yet there are many known deposits not being worked.

The only slate quarries in the State now being worked are those in El Dorado County.

Steatite is only mined in a few places in California, and the total output is small.

Travertine and onyx are mined in a few places, some of the product being of very fine character.

Tufa is mined in several counties and used for building and ornamental purposes.

## CEMENT.

### CONTRA COSTA COUNTY.

In *Oil Cañon*, a mile from the village of Stewartsville, on the ranch of Col. Coats, of Brentwood, is a large ledge of impure limestone, which is at present undeveloped but appears to be 6 ft. in width. It strikes N. and W. and dips 30° S.W. Several tons of this rock have been shipped to Antioch, where a small experimental plant has been erected, with the purpose of making "Portland" cement of this rock.

### RIVERSIDE COUNTY.

At Colton, the California Cement Company, of Los Angeles, has been perfecting arrangements during the past two years for the manufacture, by an improved process, of Portland cement, and are now producing 50 bbls. of fine hydraulic cement daily, employing 25 men. The material from which the cement is made is not a natural hydraulic limestone, but an admixture of lime, clay, and silica, after a theoretical formula—one which produces the best possible results. The quarries are at Colton, where large amounts of pure carbonate of lime are obtainable. This is ground and mixed with clay from the same locality.

### SANTA CRUZ COUNTY.

*Wagner's Park.*—Several years ago a Santa Cruz company was organized to manufacture Portland cement from material obtained in a little gulch at a place known as Wagner's Park, 1 mile N. of Santa Cruz. A reverberatory furnace, a kiln, and the necessary grinding machinery were erected, and some cement produced which, reports say, was good, but the price of the imported cement being cut to a figure below the cost of local production, put a stop to operations in that direction. The material used in the manufacture of this cement was taken from a bed of calcareous travertine, a deposit from springs. This was ground with some clayey material found in a neighboring bluff. Neither of these deposits contain hydraulic lime, but the mixture in proper proportions resulted in a merchantable cement.

### SOLANO COUNTY.

On the hills lying back of the town of Benicia, and in fact within the limits of the town, are extensive deposits of rock, which, until four years ago, was used in making cement. The article was once in demand, and

pronounced equal to the best imported. It is stated that over 130,000 bbls. were used in the construction of the New City Hall, in San Francisco. The cause of the suspension of active operations was not learned. The rock is buff in color, aphanitic in texture, and of medium hardness.

*Deming's Point.*—On the Johnson ranch, 2 miles E. of Vallejo, is a large outcrop of rock suitable for making cement. It is understood that work is soon to begin on this deposit. J. G. Johnson, of Benicia, owner.

## CLAY, BRICKS, POTTERY, ETC.

### ALAMEDA COUNTY.

*California Pottery Company.*—Its works are in East Oakland. At this establishment 12 men are employed in the manufacture of terracotta and earthenware. When in full blast about 40 men find employment. The clay used by this company is obtained from the Clark deposits, at Carbondale, Amador County.

*N. Clark & Sons' Pottery Works.*—This is the largest pottery in the county. The works are in the city of Alameda. They manufacture vitrified ironstone sewer pipe, water pipe, chimney pipe and tops, etc. The clay used in the manufacture of these articles is obtained from the extensive deposits at Carbondale, in Amador County. At the works 40 men find employment, and at the clay pits 5 to 10 men are employed.

A clay occurs at the Laundry Farm, near Fruitvale, which is being tested at the Clark pottery. The results of the experiments have not yet been made public.

*Remillard Brick Company.*—This company, whose extensive plants are found in several counties of this State, have two Hoffman kilns in Livermore Valley, 5 miles S.W. of Livermore and 1½ miles N.E. of Pleasanton. In 1893 this branch of their works produced 10,000,000 bricks, employing 110 men for six months of the year, and 4 to 10 the balance of the year. The capacity of the works is 2,500,000 bricks per month.

### CONTRA COSTA COUNTY.

Half a mile below the town of Somersville, near the railroad tunnel, a stratum of indurated white clay crosses the cañon. The deposit is 15 ft. in thickness and quite free from iron. It has never been developed in the least.

Fine clay also occurs in considerable abundance near the cement rock in Oil Cañon, near Stewartsville, and in the vicinity of the coal mines.

### LOS ANGELES COUNTY.

*City Brick Company* has a large yard on College Street, in Los Angeles, and employs 35 men. The bricks are all burned in outside kilns. The annual output is 5,000,000. The clay is obtained from banks in the yard.

*Joyce Brick Company*, in manufacturing plain bricks, use one continuous kiln, and employ 25 men. The yard is near Buena Vista Street, Los Angeles.

*Los Angeles Pressed Brick and Terra Cotta Company* has a large plant near College Street, in Los Angeles, where are manufactured plain, molded, and ornamental pressed brick, architectural terra cotta, etc., and an imitation of mottled marble. The establishment at present employs 25 men, and at times 50. Most of the clay is from Carbondale, Amador County.

#### MARIN COUNTY.

*Fortin Brick Company.*—It has a large yard at Point San Pedro, where, in 1893, were made 12,000,000 bricks, including common stock and pressed varieties. There were 140 men employed during the summer months. All the bricks are made in the ordinary outside kilns, nine in number.

*Lagunitas Station.*—Near here, on Spring Creek, and on the ranch of A. Mailliard, are extensive deposits of clay, one variety being adapted to brick-making and the other has been employed in making tiles. Neither deposit is being worked, though both are well located near the railroad.

*Patent Brick Company.*—Its plant is at Brick Yard, a station on the S. F. & N. P. R. R., 4 miles N.E. of San Rafael.

*Remillard Brick Company.*—Its large yard is at Green Brae, 2 miles from San Quentin Prison. This concern, in 1893, made 6,000,000 bricks in its Hoffman kiln, working three and one half months, during which time 95 men were employed. In April, 1894, only 7 men were at work. This is but one of the three large yards owned by the Remillard Company.

#### NAPA COUNTY.

*Brick clays* are found and dug near Napa City.

#### NEVADA COUNTY.

In Sec. 3, T. 12 N., R. 9 E., as also N.W. of Nevada City, near the banks of the river, deposits of kaolin of sufficient size and purity to be available in the manufacture of the finer qualities of china are known to exist, but have never been put to any commercial use. Samples from the latter place are said to have been highly spoken of in Europe, where they were tested by experts.

*Nichols Mine.*—In Sec. 3, T. 15 N., R. 9 E., is an abandoned mine at one time worked for gold. The one wall of the quartz vein is a very white kaolin, apparently at least 6 ft. in thickness, that follows the vein for a great distance.

#### PLACER COUNTY.

The clays of Placer County have become a source of large manufacturing interest, from the great adaptability of the raw material to manifold uses. The large clay beds have undoubtedly been formed from the erosions and washings of the granite rocks that flank the east side of the county. Near the town of Lincoln these beds are furnishing the raw material for a large pottery.

*Gladding, McBean & Co.'s Potteries.*—These works are situated on the edge of the town of Lincoln, and employ 150 men. The works comprise



5 acres of buildings and sheds on the north end of the town, and 20 acres of ground nearly a mile away on the main road. The clay banks that furnish the raw material have a volcanic capping about 10 ft. in thickness. The material is dug and shoveled into carts that haul it to the works. The several grades being heaped by themselves, are mixed and worked over according to the finished product to be furnished. The works produce fire-brick, terra cotta ware, architectural work, ironstone ware, vases, flower pots, acid receivers, sewer pipe, and tiles. In the works are 15 circular and 2 long furnaces, besides the necessary mixing, grinding, and pugging mills. From 10,000 to 20,000 cords of wood are consumed per year at a cost of \$60,000, being delivered from the surrounding neighborhood. For special purposes a small amount of a particular grade of clay is imported. The motive power is a 150 horsepower steam engine supplied by a battery of four boilers, the waste steam being carried through pipes under the drying-room floors. The payroll per month averages from \$6,000 to \$12,000, the wages varying from \$1 75 to \$8 per day. Reference to this property and the composition of the clays may be found in our IXth and XIth Reports, pp. 297 and 321. Gladding, McBean & Co., of Lincoln P. O., owners.

## SACRAMENTO COUNTY.

*Capital Sewer Pipe Works.*—They are located in the eastern part of Sacramento City. See our Xth Report, p. 509.

*Sacramento City.*—In the southern outskirts of this city are the yards of Fountain Bros. and of J. Ryan. See our Xth Report, p. 508.

*Sacramento Transportation Company.*—This company has two large yards, one at Riverside and one at Freeport, being on the Sacramento River 5 and 9 miles, respectively, below the city of Sacramento. See our Xth Report, p. 506.

## SANTA CRUZ COUNTY.

*The F. A. Hihn brick-yard*, on San Lorenzo Creek, near Felton, in 1893 turned out 100,000 bricks, which were used by the manufacturers in their own work. This concern only burns brick as they are required in their business as contractors.

There are vast beds of indurated clay in this county, but none of it is being put to any use. That on the Hodge ranch, near *Glenwood*, has been pronounced good, and some experiments made with it resulted satisfactorily, but the deposit remains unworked. A blue clay, which burns white, has been found in the *Valley of the San Lorenzo*, on the Zyante tract, but it has never been developed, and its extent is unknown.

*Santa Cruz.*—The bluffs all about the city of Santa Cruz contain large amounts of clay in thick-bedded deposits, of which no use is being made at present. There is also some clay in deposits in the bluffs of some small gulches tributary to the San Lorenzo Valley, said to be suitable for making some of the common kinds of pottery.

All the bituminous deposits in this county, as far as observed, are overlaid by a stratum of hard clay, some of which breaks with a conchoidal fracture, and seems quite free from iron.

## SONOMA COUNTY.

Good clay occurs at a score of places along Sonoma Creek, between Glen Ellen and Sonoma. Several years ago large kilns of brick were burned at Glen Ellen and near Madrona Station, which were used in the construction of the Home for Feeble-Minded Children at Glen Ellen, but no bricks are made there at present.

*Bagley & Nagle Brick-Yard.*—This is situated  $1\frac{1}{2}$  miles W. of the town of Santa Rosa. When operating, 6 to 8 men are employed. The output does not exceed 500,000 bricks per annum. The bricks are burned in the ordinary manner in outside kilns. This yard is operated entirely to supply the local demand.

## STANISLAUS COUNTY.

*The Oscar Reed Clay Bank.*—A good quality of pottery clay has been discovered on the ranch of Oscar Reed, in Sec. 3, T. 3 S., R. 11 E., M. D. M.

## YUBA COUNTY.

*Dempsey's Ranch.*—A deposit of a good quality of white clay, mixed somewhat with iron sulphides, has been found on John Dempsey's ranch, 3 miles S.E. from Smartsville, in Sec. 2, T. 16 N., R. 5 E. It has been proven to be 12 ft. wide and 1,500 ft. long. Nothing is being done with it. It is 18 miles from the railroad, and there is an abundance of water and pine and oak timber in the vicinity.

## GRANITE.

Among the rock formations suitable for building purposes at present made use of in the State, the granites easily take the first rank, being found throughout the whole length of the State; but as the question of transportation figures largely in the use of such materials, only those localities have so far become prominent that have easy access to railroad or water communication with the principal cities of the State. Thus we find granite quarries along the railroads that flank and cross the western slope of the Sierra Nevada Mountain ranges, more especially in the counties of Sacramento, Placer, Nevada, Madera, etc.

## CALAVERAS COUNTY.

Granite of fine texture and valuable as a building-stone is found in the West Point District, but is not quarried, except in limited amounts.

## PLACER COUNTY.

*Brady Quarry.*—This is in Sec. 29, T. 11 N., in Rocklin District, near the C. P. R. R. It is a small property. — Brady, of Rocklin, owner.

*Burns & Coffey Quarry.*—This is situated in Lincoln, a railroad station between Sacramento and Marysville. The work of the quarry consists mainly in working up granite boulders. The owners employ 4 men, 2 of whom are stonecutters. Two derricks are used. Burns & Coffey, of Lincoln, owners.





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## GRANITE.

## MADERA COUNTY.

• The general appearance of the country about the town of Raymond would scarcely suggest the existence of fine quarries of granite, as the hills are smooth and rolling and the surface rock usually much decomposed to a considerable depth. Here and there are found large masses of hard, firm rock, in some of which quarries have been opened.

*The Day Quarries.*—There are two quarries, one being 3 and the other 4 miles S. of Raymond. These quarries being both new gave employment to but 33 men. The granite in quarry No. 1 of the Day Company is similar to that of the Raymond and McLeanan companies, excepting that in some portions of the mass large crystals of hornblende half an inch or more in length have developed. The Day quarries each are in close proximity to the railroad.

*McLeanan Quarry.*—This is 3 miles S.E. of Raymond, on a spur of the railroad. This quarry employed 50 men in May, 1893. The quality and general appearance of this granite are similar to that of the Raymond Quarry.

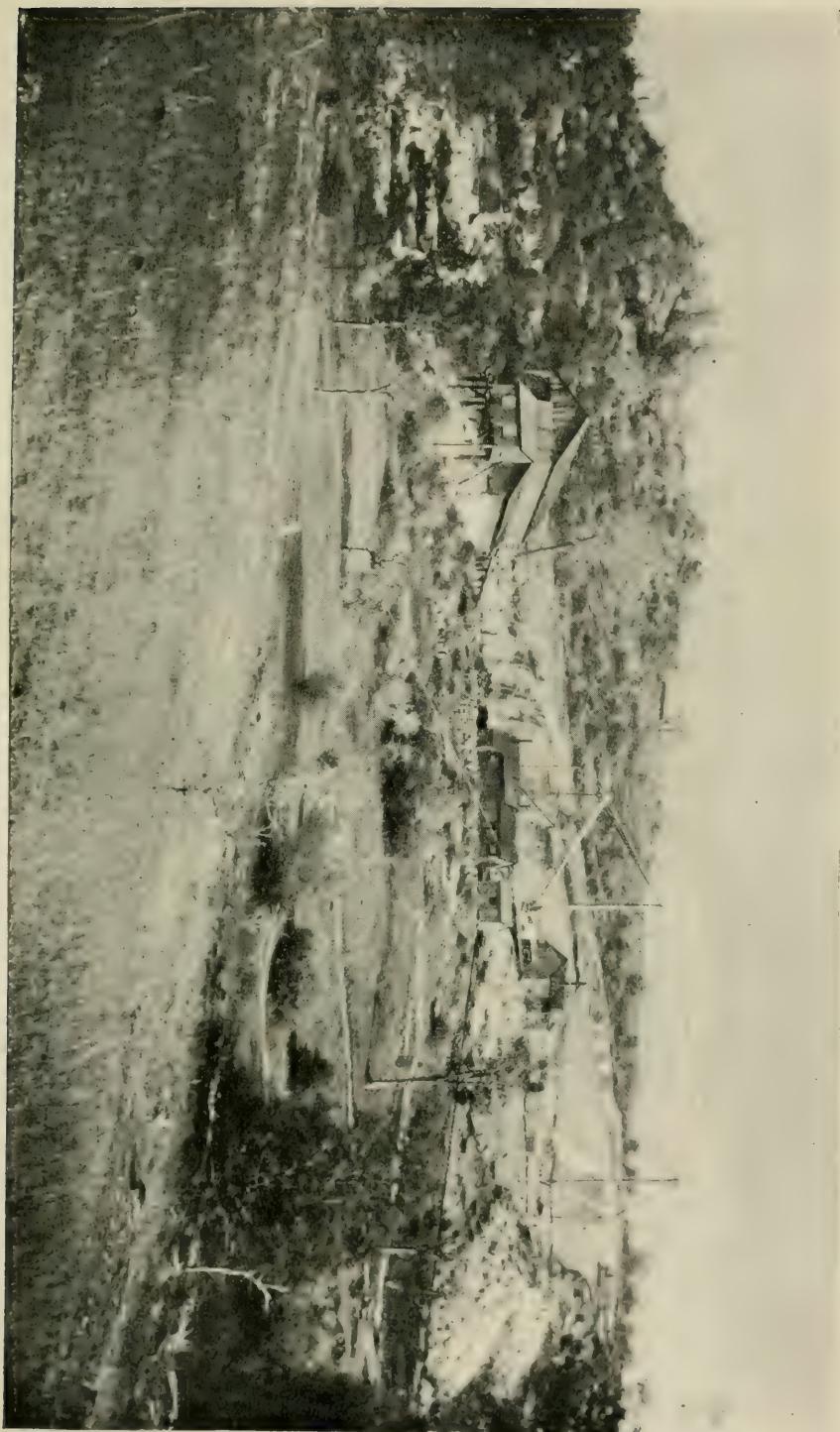
*Raymond Quarry.*—This property is  $3\frac{1}{2}$  miles S.E. of the town of Raymond. It has a superior location on a large dome-shaped hill in which the granite occurs in concentric layers, conforming in a general way to the contour of the hill. The blocks of stone are of immense size. The one on which the work was being concentrated in the spring of 1893 was 325 ft. long, 5 to 15 ft. in thickness, and exposed for 50 ft. in width, without seam or flaw. The granite is fairly fine-grained, light gray in color, consisting of quartz, orthoclase feldspar, some plagioclase biotite mica and hornblende. It has a remarkably even texture, free from those spots caused by the accumulation of the dark-colored minerals which are so objectionable in structural material. A spur from the railroad runs directly into the quarry; 70 men were employed in May, 1893.



Raymond Granite Quarry, Madera County.







Raymond Granite Quarry, Madera County.



*Calderwood Quarry.*—This is a small quarry in Lincoln. — Calderwood, of Lincoln, owner.

*Copp & Waters Quarry.*—This is in Sec. 29, T. 11 N., in Rocklin District. It is one of the larger quarries of the county, having a lease of 40 acres of ground and employing 25 men, of which number 16 are quarrymen and stonecutters. Two steam derricks are in use, run by a 25 horse-power horizontal engine. They work on an outcrop 25 ft. high. Copp & Waters, of Rocklin, owners.

*Eureka Quarry.*—The workings are on leased ground, and consist of a pit 200 ft. long by 75 ft. wide and 70 ft. deep. The equipment consists of a horizontal engine and two derricks. Nine men are employed—7 quarrymen at an average pay of \$2 40 per day, and 2 stonecutters at \$4 per day. The principal market for the granite is Sacramento, San Francisco, San José, and Stockton, and the cost in the rough f. o. b. is 85 cents per cubic foot. Eureka Quarry Company, owners; A. M. Grindell, of Rocklin, Secretary.

*Gould & Towle Quarry.*—This is situated 250 yds. from the main C. P. R. R. track,  $4\frac{1}{2}$  miles from Emigrant Gap Station, at Yuba Pass; a side track connects the quarry with the main line. The granite is hard, and of pretty good quality. The pit is small as yet, but well situated as regards dumping facilities, wood, water, and accessibility. It is supplied with a derrick and a small steam engine with upright boiler and 18 in. cylinder. Gould & Towle, of Dutch Flat, owners.

*Griffith Quarries and Polishing Works.*—These are half a mile E. of Penryn. Four men are employed at present, but when full-handed there are about 200 at work. The property lies in Sec. 35, T. 11 N., R. 7 E., comprises 300 acres, and produces two qualities of granite, white and black—it is said to be the only true black granite quarry in the State—and consists largely of boulders. The price of the granite in the rough is, for small blocks, \$1 per cubic foot; for pieces weighing from 10 to 20 tons, from \$2 50 to \$3 50 per cubic foot. The granite belt courses N.W., and has been sunk on in these works to a depth of 75 ft. It is claimed that the stone will not fade or change color. This quarry is supplied with polishing works, which cost \$20,000, situated between Penryn and the quarry, adjacent to a railroad siding. They contain the requisite machinery to turn stone columns 30 ft. long; also for polishing curved surfaces, and blocks of stone 25 ft. long by 6 ft. wide. It takes seven days to polish such a block. D. Griffith, of Penryn, owner.

*Grimes Quarry.*—This is near Lincoln and employs 4 men—2 stonecutters and 2 quarrymen.

*Jeter Quarry.*—It is at Lincoln. There is a small pit 30 ft. deep, requiring two derricks and giving employment to 5 men—2 stonecutters and 3 quarrymen. Mrs. Keller, of Lincoln, owner.

*Kent Quarry.*—This is in Sec. 29, T. 11 N., in Rocklin District, on 10 acres of leased ground. When the property is being worked 5 stonecutters, 5 quarrymen, a teamster, and a blacksmith comprise the crew. Three small derricks are used, manipulated from a small upright engine. S. Kent, of Rocklin, owner.

*Paran Quarry.*—This is near Lincoln, and is worked with a force of 2 stonecutters and 2 quarrymen. Paran Bros., of Lincoln, owners.

*Quinn Quarry.*—This is in Sec. 29, T. 11 N., near Rocklin. The property contains 150 acres. The quarry is small, using two derricks



and employing 12 men; 3 of these are stonecutters. Mrs. Mary Quinn, of Rocklin, owner.

*Robert Bros.' Quarry.*—This is near Penryn; a small concern, employing 3 men, working on leased land. Robert Bros., of Penryn, lessees.

*Rocklin Quarry.*—This property of 80 acres is in Sec. 29, T. 11 N., near Rocklin. The main pit is 300 ft. long, 175 ft. wide, and from 100 to 125 ft. deep. It is supplied with four large derricks, capable of handling blocks weighing from 25 to 30 tons. They are now erecting a traveler, polisher, and steam dresser. An Ingersoll machine drill is used where practicable. This quarry has been worked from sixteen to eighteen years, and has a yearly output of 3,000 tons of finished material; 10,000 tons of rubble are disposed of for ballast, and 250 tons for street blocks. There are 20 quarrymen employed at \$2 50 per day, and 32 stonecutters at \$4, besides an engineer, teamster, 4 blacksmiths, and 2 tool-boys—60 men in all. Besides the local markets in this State, shipments are made to Oregon and Washington. The railroad freight charges from this point are, for rough ashler, \$2 50 per ton; for finished work, \$3 50. J. L. Delano, of Rocklin, President and owner.

*Tamarack Quarry.*—This is about 4 miles beyond the C. P. R. R. station at Cisco, in immediate proximity to and on the upper hillside of the track, permitting the blocks to be brought to the cars by gravity. A face of several hundred feet can be obtained over 100 ft. in height above the track level. The granite shows a granular crystalline texture. The planes of the formation are nearly vertical. C. P. R. R. Co., of San Francisco, owners.

#### SACRAMENTO COUNTY.

*State Granite Quarry at Folsom.*—Capt. Charles Aull, Warden of the Folsom Prison, states that during the four years ending June 30, 1894, more than 120,000 cu. yds. of granite were taken from the prison granite quarry. That of this amount about 110,000 cu. yds. were used in the dam, canal, and power-house constructed by the Folsom Water Power Company in conjunction with the State of California, and that about 3,000 cu. yds. of granite have been used in a new cell-building. In the latter building very massive masonry is employed. Thus, in the new dungeon there are blocks of stone 8x2x2 ft. In the roof of the ordinary cell some of the blocks of stone are 92x25x36 in. He also says that other buildings are in course of erection which will require about 3,000 cu. yds. of granite, a large portion of which is already quarried.

#### SAN BERNARDINO COUNTY.

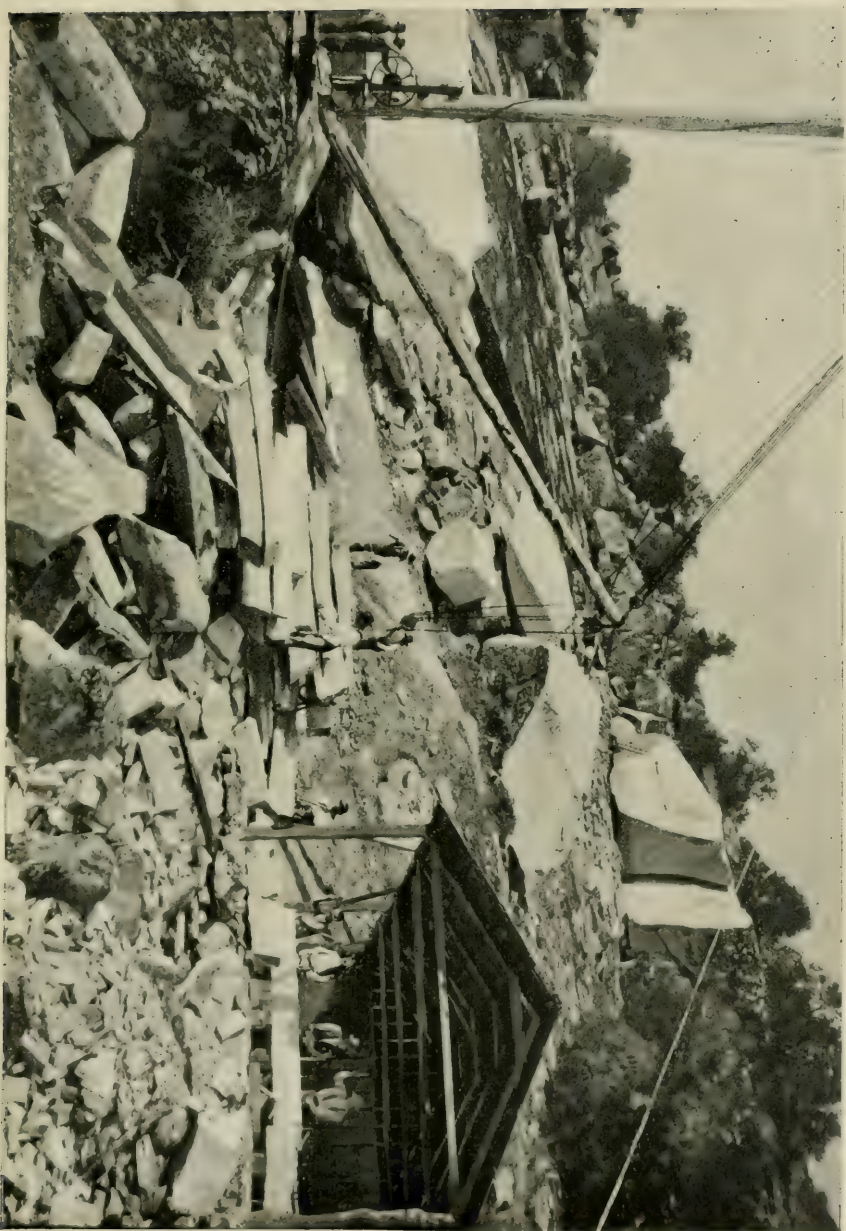
*Turner & Leahy Quarry* is being opened,  $3\frac{1}{2}$  miles N.E. of Victor Station. The granite is fine and even textured, and occurs in great massive blocks, which can be quarried in any size to suit requirements.

*Clemens Quarry* is on the Southern California Railroad,  $3\frac{1}{2}$  miles N. of Victor. Six men are working.

*St. John Quarry*, half a mile S. of Victor. Idle.

#### SAN DIEGO COUNTY.

*The Waterman Quarry* has been opened but a few months. It is situated on the Cuyamaca and Eastern Railroad, at Forster Station. Here 50 men are employed quarrying rock for the jetty being built at



Rocky Point Marble Quarry, Tulare County.





Rocky Point Granite Quarry, Tulare County, showing Indian paintings and effects of a blast.





the entrance of San Diego harbor. An average of 20 carloads of stone are shipped out daily. A spur of the railroad has been built into the quarry, and every facility provided for the economical and speedy handling of the large quantity of material being removed.

*The Rockfellow & Clark Quarry* is 2 miles above Forsters, in the same cañon. Only a small force is employed on contracts, and these do not find work constantly.

#### SANTA CRUZ COUNTY.

There is a poverty of good building-stone in this county. Several attempts have been made to open quarries, but none have developed good stone in sufficient quantity to make their quarrying profitable.

The trimmings of the court-house are from granite boulders found on Blackman Gulch, a short distance E. of Santa Cruz, and is the best granite ever found in the county, though that is rather coarse-grained and dresses roughly.

Some granite of loose texture is taken by the railroad company at various points along the line, and the rock used for ballast, etc.

*Delaney Quarry.*—It is on Laguna Creek, 12 miles N.W. of Santa Cruz. The rock is too soft, and does not occur in masses large enough to make the stone merchantable.

*Kerr Ranch Quarry.*—This quarry, 2 miles E. of Santa Cruz, has been abandoned, owing to the poor quality of the stone, and all attempts to find more serviceable granite have been given up.

A dike of dark-colored, bluish rock (diorite) occurs in the granite at Agua Caliente, on the S. P. R. R., near Pajaro Station. The dike is 5 to 6 ft. in thickness and the rocks take a fine polish. The ledge is too small to make a quarry profitable, unless a very high price was obtained for the stone.

#### TRINITY COUNTY.

*Rush Creek Quarry.*—It is 6 miles E. of Weaverville, on Rush Creek. A 200 ft. face is being opened; the granite to be used principally for ornamental and monumental purposes.

#### TULARE COUNTY.

*Griffith & Owens Quarry.*—This quarry is at the eastern base of Rocky Hill, about  $3\frac{1}{2}$  miles E. of Exeter, on the S. P. R. R. The granite is gray syenitic rock, of very uniform texture and color, which splits readily in any direction and takes a fine polish. It occurs in large detached masses and flattened beds; the latter pitch a little E. of N. at an angle of about 30°. These beds vary from 3 to 25 ft. in thickness, and are so situated that a back of any required height may be obtained to the quarry. The "rift" appears to be E. and W. This stone has been used in San Francisco, Oakland, and other cities. In quarrying this rock two holes are drilled about 15 in. apart, and at such an angle that they intersect one another about 6 ft. below the surface. The holes are first charged with 6 in. of black powder and fired; they are then loaded with 8 in. of black powder and fired again; lastly they are charged with 12 in. of black powder and fired. By this means a block of granite 40x25x40 ft. is sometimes split through its greatest length. Ten men are employed in this quarry. Griffith & Owen, of Exeter, owners.



## MACADAM.

## ALAMEDA COUNTY.

The business of quarrying rock for macadam and concrete is quite an important industry of this county, no less than 250 men finding employment in the quarries and in work connected directly with the business, principally teaming, building concrete walls, and macadamizing streets. The busy time of the year is during the summer months. The winter force is not more than one third of that employed in summer.

The rock produced at the various quarries in this county, with the exception of that at Laundry Farm, is the altered greenish-gray sandstone common to the Coast Range. Only that at the Farwell Quarry is suitable for building-stone.

*California Improvement Company's Quarry.*—It is on the Laundry Farm, 1 mile N. of Mills College, and on the summit of a prominent ridge. The rock is anamesite, a variety of basalt of extremely fine texture. As far as opened, the quarry exposes no rock suitable for building-stone. A gravity tramway connects the quarry with the breaker works and bins, which are at the upper terminus of the California Railroad. In 1893 the monthly production was 5,000 cu. yds., and in 1894 to May 1st, 7,000 cu. yds. The output later in the season is expected to exceed this. In the busy season from 50 to 60 men are employed, and in the winter 25 to 30. Indirectly, on contracts, teaming, etc., 35 to 65 men are employed, according to the season.

*Claremont Quarry and Paving Company.*—Its quarry at Claremont is in the foothills between Oakland and Berkeley, near the head of Little Lake Chabot. There were 28 men employed last spring.

*Farwell Quarry.*—It is in Rocky Brook Cañon, a tributary of Niles Cañon. The quarries are on each side of the gorge in which they are situated, about  $1\frac{1}{2}$  miles from the railroad, and are in two groups, being situated on each side of an anticlinal fold. The rock is shattered and broken, and much waste results from quarrying. Its color is a dark bluish-gray; that of those portions near the surface is buff and light gray. The stone is very durable, and commands a good price in the cities of Oakland and San Francisco. In 1893 about 10,000 cu. ft. of rock were shipped. From 10 to 20 men are usually employed.

*McAdams Quarry.*—It is in Medos Cañon, back of Piedmont, and is a small quarry, producing sandstone for rubble and ashler. It is not worked regularly.

*Oakland Paving Company's Quarry.*—It is on McAdams Street, near Broadway, Oakland, and is a very large quarry, which has been operated for twenty years or more. This quarry has produced from January 1 to May 1, 1894, about 6,000 cu. yds. of rock for macadam and concrete. Steam power drills are used, and 50 men are employed.

*Piedmont Paving Company's Quarry.*—It is in the foothills back of Piedmont, about half a mile from the site of the old Piedmont Hotel. During the summer season of 1893, 20,000 cu. yds. of broken rock were produced, 35 to 40 men being employed.

*Sheep Island Quarry.*—It has not been operated since the breaker works were burned a year or two since, and as far as learned there is no prospect of an immediate resumption of operations.

## LOS ANGELES COUNTY.

At *Acton*, on the line of the S. P. R. R., 55 miles N.E. of Los Angeles, occurs a dark-colored, half-glassy lava, suitable for rubble work, macadam, and perhaps also paving-blocks and building-stone. It is admirably situated for quarrying and loading on cars. The deposit is entirely undeveloped, except for a little taken for local use.

## MARIN COUNTY.

*Forbes Quarry*.—This is on the hillside N. of San Rafael, and in 1893 produced 6,000 cu. yds. of flint rock, which was crushed and used for macadam on the streets of San Rafael, and in concrete work. There were 700 cu. yds. quarried in April, 1894. When in full operation, 30 quarrymen and teamsters are employed.

*Hotaling Quarry*.—This is situated in the southwestern suburbs of the city of San Rafael. In winter 3 men are employed, but in the summer season 8 to 10 men are kept busy. In 1893 this quarry produced 1,600 cu. ft. of rubble rock, and in 1894 to May 1st, 11,000 cu. ft. A rock-breaker is to be set up at this quarry to crush the waste for macadam and concrete work. This quarry has produced within the past year 10,000 ft. of gutter rock. The rock is the dark bluish-gray sandstone common to the Coast Range. A dike of light-colored, much decomposed rock 20 ft. in thickness is exposed in the quarry.

*Mount Tamalpais Quarry*.—It is worked occasionally by the Mount Tamalpais Cemetery Company to get rubble rock and macadam. The rock is a bluish-gray metamorphic sandstone. The quarry has never been extensively opened. The stone is hard and well suited to the purposes for which it is used.

*Parrott Quarry*.—It is in the west suburbs of San Rafael; has been idle for some time past.

## SAN FRANCISCO COUNTY.

The only rock industry of San Francisco consists of the quarrying of the blue metamorphosed sandstone common to the Coast Range, and of the red jasper rock. These rocks are excavated from the quarries mostly in the southwest suburbs of the city. There is also one quarry on Telegraph Hill. The material is used in making the concrete foundations of buildings, cement sidewalks, and in some instances concrete walls for buildings, several of which have recently been constructed. The material also finds a limited use as macadam. A large quantity of the blue sandstone has been placed in that portion of the seawall at the new ferry slips foot of Market Street. This rock has not been in place a sufficient length of time to determine what action, if any, the salt water will have upon it.

*Blue Rock Quarry*.—It is at the corner of Douglas and Twenty-sixth Streets. The rock from this quarry is that placed in the seawall. It is also used to a limited extent for ashler. From 10 to 20 men are employed. The estimate of the production for the year 1893 by the owners is 27,000 cu. yds. Gray Bros., 310 Montgomery Street, San Francisco, owners.

*Eureka Stone Quarry.*—It is at the corner of Eighteenth Street and Corbett Road. The rock quarried here is iron-stained, and of the jasper variety. The rock-mass shows a decided tendency to break up in small angular fragments with nearly parallel sides. From 30 to 35 men find employment at this quarry. In 1893 it is estimated that 47,000 loads were marketed. Champion, Elder & Co., 302 Montgomery Street, San Francisco, owners.

*Flint Tract Quarry.*—It is on the opposite side of the hill from the Wegscheider Quarry, and is at the corner of Tilden and South Broderick Streets. Twenty men are employed. A new crusher and sizing plant is now being erected (March 1, 1894). Diggins Bros., 16 Post Street, San Francisco, owners.

*Telegraph Hill Quarry.*—It is on Telegraph Hill, near the corner of Sansome and Green Streets. The rock quarried here is sandstone similar to that at the Blue Rock Quarry. The owners state that during 1893, 30 to 40 men were employed, and the output is estimated at 35,000 cu. yds. Gray Bros., 316 Montgomery Street, San Francisco, owners.

*The Warren Leases.*—One is near the Flint tract quarries, another on Bernal Heights. Neither of them are working at present, and are seldom operated steadily. Chas. Warren, Ninth Street, near Howard, San Francisco, lessee.

*Wegscheider Quarry.*—It is situated in the Flint tract. The quarry employs 20 men; and in 1893 produced 15,000 cu. yds. of rock. Wegscheider & Co., 404 Seventeenth Street, San Francisco, owners.

There are in addition to the quarries mentioned several small ones, which are operated at intervals, the owners not making a steady business of it.

#### SOLANO COUNTY.

*Benicia Rock Crushing Company's Quarry.*—It is on the line of the S. P. R. R., half a mile N. of Goodyear Station. The rock is of volcanic origin, and is seemingly a portion of the flow which occurs at Cordelia and northward. It was used formerly for paving-blocks, but the uneven wear due to its varying hardness made it valueless for this purpose, and it is now broken for macadam and concrete. Twenty-five men are usually employed.

*Thomason Quarries.*—These are 1 mile E. of Cordelia, and produce principally paving-blocks; the refuse is run through rockbreakers and used for macadam. In busy times 60 to 70 men find employment, and in ordinary seasons (summer) at least 20 to 30.

#### SONOMA COUNTY.

On *Castle Hill*, in the city of Petaluma, is a large quarry, from which material is obtained for macadamizing the streets of the city and the county roads near the town. It is supplied with large bins and breakers. The quarry is managed by J. L. Hall.



## MARBLE, LIMESTONE, AND LIME.

## AMADOR COUNTY.

*Carrara Marble Quarry.*—This property is situated  $6\frac{1}{2}$  miles N.E. of Jackson, on Sutter Creek. The marble found in this quarry is fine-textured, quite white, but lightly banded or mottled with bluish streaks, veins, and clouds. The stone is shipped by road and rail to San Francisco, where it is sawed and dressed. There are a number of quarries on this belt, but the above-mentioned quarry is the only one of importance. It is worked intermittently as the demand requires.

*Miscellaneous Quarries.*—Marble occurs at numerous places in this county, but none of them are regularly worked.

Seven miles N.E. of Ione is a large reef of red crystalline limestone (marble), which is fully described in our VIth Report (Part I), p. 22. The quarries are idle.

Some quarries on the road between Plymouth and Oleta produce marble of good quality. These quarries are idle.

## CALAVERAS COUNTY.

Marble is abundant, though not quarried regularly. Some very fine marble occurs at the mouth of Wade's Gulch, on Coyote Creek, 2 miles below Vallecito. Marble of good quality is found near the Stanislaus, opposite the Columbia quarries, in Tuolumne County. Large quarries have been opened near Valley Springs, which produce an excellent marble.

## EL DORADO COUNTY.

Although there are several bodies of limestone and some good qualities of marble to be found in this county, the resources in this direction have not been very largely developed.

*Bind & Co.'s Marble Quarry.*—This is 5 miles S.E. of Placerville, and 4 miles from Diamond Springs, on Weber Creek. The property consists of 160 acres of ground, 1 mile long on the course of the belt, which is W. of N., by one fourth of a mile wide. The same belt can be seen on the American River, where it shows about 50 ft. wide; both N. and S. it appears to wedge out. There are three varieties of the marble: milky-white, brown and white mottled, and blue-gray. A face of 150 ft. in length can be made, and a track will be laid down-grade to the railroad at Diamond Springs. Water power may be obtained through the Crawford system of ditches, and the necessary saws and polishing tables have been ordered. Ed. Bind, of Placerville P. O., owner.

*Cave Valley Lime Company.*—The property of this company is situated on the stage road between the American River and Cool, a stage station 5 miles S.E. from Auburn. The works are only run during the summer months. The belt of blue limestone is about 1,000 ft. wide, and can be traced on a N.W. course over 4 miles. The two patent kilns are situated on the main road, while the quarry is opened on the upper side of the road on a level with the top of the furnaces. The kilns are 30 ft. high, 6 ft. across, with two fires, consuming 4 cords of wood per day. The kilns work continuously; a charge is drawn every four hours, producing from 150 to 160 tons per month. Wood is cut in the neighborhood and

costs \$3 per cord. The lime is hauled to Auburn for \$4 per ton, and is sold for \$15 per ton at retail, or \$10 per ton by the carload. When working, 8 men are employed, 3 of them in the quarry. W. Davis and Henry Cowell, of San Francisco, owners.

#### INYO COUNTY.

*Inyo Marble Company.*—The quarries of this company are situated at the base of the Inyo range, between Keeler and Lone Pine Station. Their claims are scattered along the base of the range for several miles, but the point at which most of the work has been done is about 5 miles N. of Keeler. The management of the quarries has recently changed, and several new and apparently excellent beds of marble have been discovered. One of the best of the new locations lies about 2 miles S. of the old works. Although not opened up at the time of the Bureau's examination, there is shown a large body of banded and variegated marble, free from cracks and flaws, so that large pieces can be obtained. This marble varies from nearly white to gray and black in bands, and often beautifully mottled and knotted. For the general purposes of a variegated marble it would seem that this would completely fulfill the requirements. A little south of the old quarries a bed of fancy variegated marble is being opened. It is mottled with white, yellow, gray, and black, and is penetrated by beautiful dendritic markings of manganese. The old quarries of white marble are to be abandoned, because of the broken condition of the rock, and a new one has been opened near by. The marble found in the latter gives promise of a more perfect white color, and of being obtained in larger blocks. Recently pieces of 15 to 18 tons weight have been obtained. A half mile north of the main works a new quarry of yellow marble is being opened. A deposit of black marble of good quality has also been found, and is employed chiefly for floor tile. Development work is being actively pushed, and it is expected from present indications that the demand will rapidly increase. These quarries were described in our Xth Report, p. 215. Inyo Marble Company, of San Francisco, owners; M. J. McDonald, Mills Building, President.

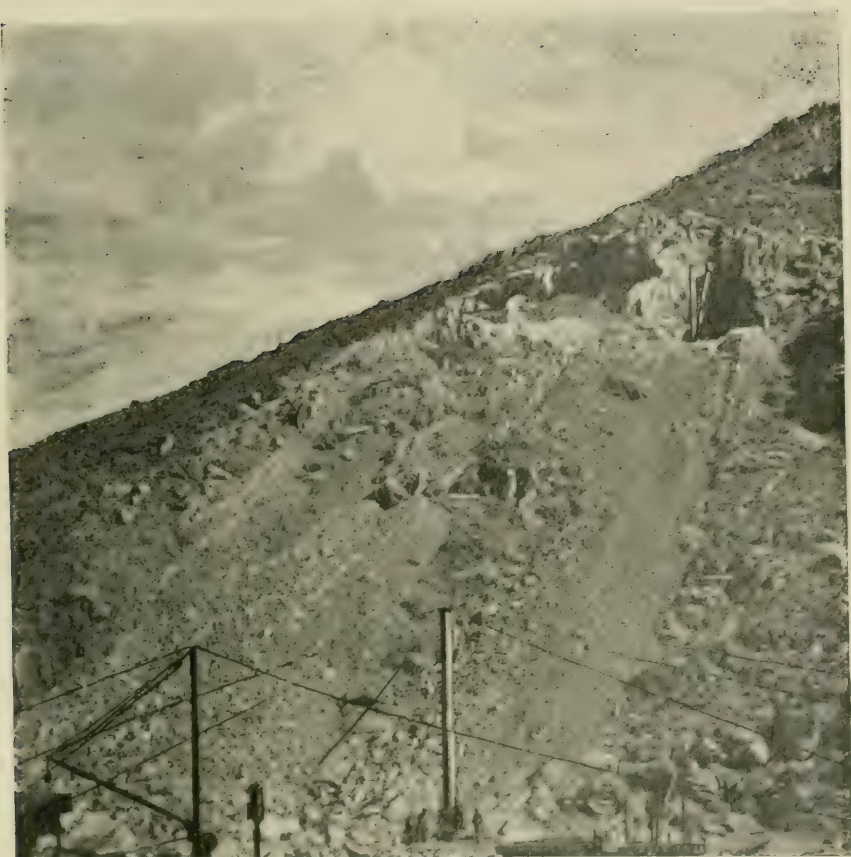
#### LAKE COUNTY.

*Two Occurrences.*—Limestone is found in the vicinity of the Abbott Quicksilver Mine, and also at Burns Valley, where the Sulphur Bank Mining Company has two limekilns.

#### MONTEREY COUNTY.

*Nelson Creek.*—Large bodies of crystalline limestone, free from impurities, outcrop along Nelson Creek, a tributary of Indian Creek. These beds are easily accessible by road from San Miguel, from which place they are distant 18 miles.

*Rockland Lime and Lumber Company's Quarry.*—On the coast of Monterey County, 30 miles below Point Sur, is an immense body of crystalline limestone extending down from the high mountains to within about a mile of the ocean, between the two branches of Milk Creek. Below one of the most prominent outcrops of this limestone four continuous kilns have been erected, and a road built down the creek





costs \$3 per cord. The lime is hauled to Auburn for \$4 per ton, and is sold for \$15 per ton at retail, or \$10 per ton by the carload. When working, 8 men are employed, 3 of them in the quarry. W. Davis and Henry Cowell, of San Francisco, owners.

#### INYO COUNTY.

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#### LAKE COUNTY.

### MARBLE.

#### MADERA COUNTY.

A belt of crystalline limestone, some of which would make handsome structural and ornamental marble, occurs on the south side of the South Fork of Merced River, near Hite's Cove, where it is exposed on the graded road. No effort has ever been made to develop it.



Inyo Marble Quarries (white)





to the ocean. The limestone beds have been so crushed that no solid mass has been found; simply angular blocks of all sizes, great numbers of which have fallen at the base of the ledge. It is from these chiefly that the lime is made. In places the limestone is perfectly pure; in others it contains much mica and molybdenite, making it necessary to sort it for the kilns. The limestone is here in such quantity, and so convenient to the water, that it is difficult to see why the work has been abandoned. See our VIIIth Report, p. 410.

## NEVADA COUNTY.

Several belts of limestone and marble are known in this county, and are worked on a small scale. The general trend is N. and S.

*South Yuba Marble Company.*—This property is situated in Sec. 18, T. 17 N., R. 10 E., 2 miles S.W. from North Bloomfield, on the South Yuba River, in North Bloomfield Mining District. It consists of three claims on the river between Edwards' and Purdon's bridges, near where Humbug Cañon enters the South Yuba, each claim consisting of 1,500 by 600 ft. The principal limestone belt, which is about 600 ft. wide where it crosses the river, has a N. and S. course and crops out most prominently on the S. side. The other two claims are half a mile farther down the river, the limestone showing a more N.E. trend. It lies 6 miles from the Colfax and Nevada Narrow Gauge Railroad, and will require the building of a rather expensive road. The following varieties of marble can be obtained: Black, mottled, and variegated, which take a high polish. At present 5 men are employed. W. H. Kallenberg, of North Bloomfield, owner.

## RIVERSIDE COUNTY.

*Colton Quarry.*—The California Portland Cement Company, of Los Angeles, is quarrying marble for buildings and curbstones, and also for making macadam, at their quarries near Colton. The marble is also ground and sold for the manufacture of carbonic acid gas by soda works.

*San Geronio Pass.*—A large ledge of handsome white marble occurs a few hundred yards west of the line of the S. P. R. R., at the foot of San Geronio Pass, a short distance below Whitewater Station. The ledge is 60 ft. in width. It is entirely undeveloped. Some of the marble is fine-textured and as white as snow. The greater portion is rather coarse. It is often banded and blotched with bluish streaks and spots.

## SAN BENITO COUNTY.

*Cienega Lime Company's Quarry.*—This quarry is about 7 miles S. of Tres Pinos, on the northeastern slope of the Gabilan range. The limestone is generally a coarse crystalline variety, quite pure and clear. Portions are very compact and fine-grained, being suitable for use as marble. The color is pure white. Large blocks can be obtained and the quantity is unlimited, for the ledge extends in a N.W. direction, more or less broken, to and past Fremont Peak. There are four continuous kilns on the property. See our VIIIth Report, p. 488. O. W. Tupper, of San José, Superintendent.

## SAN BERNARDINO COUNTY.

*In Bear Valley Region* deposits of excellent marble occur.

*The Gem Quarries*, near Victor, are well known as producers of an excellent quality of fine variegated marble.

*Near the Black Hawk Mines*, 18 miles E. of Rabbit Springs, there occurs a very fine white, fine-grained marble.

## SAN LUIS OBISPO COUNTY.

*E. Smith's Property*.—It is 3 miles N.W. of Adelaide P. O., and is a great mass of Tertiary limestone. In past years much lime of an excellent quality has been produced here.

Ten miles N.W. of Paso Robles is another limestone bed. It is 100 ft. thick and of the same age and character as that just mentioned.

## SANTA CLARA COUNTY.

In former years considerable quantities of lime were made in the vicinity of Los Gatos and near Guadalupe, but the industry has long since been discontinued, owing to the frequent and increasing occurrence of flinty nodules in the limestone, the entire mass of lime rock becoming finally too silicious to make good lime.

*Wright's Ranch*.—On this ranch, 5 miles S.E. of the New Almaden Mine, is a large and valuable deposit of marble. It contains none of the flinty nodules or secretions of quartz commonly observed in marbles. Its color varies somewhat, light shades of gray, occasionally tinged with red or brownish shades, predominating. Some portions are nearly white, but it is mostly mottled or curiously marked by blotches and streaks of light shades in the darker crystalline ground-mass. The marble takes a high polish and is firm and free from flaws. But very little has been done to develop this deposit of marble, which outcrops from 60 to more than 100 ft. in width, standing above the surface in several places from 10 to 30 ft. nearly vertical, and extends continuously for over 3,000 ft. On the surface exposures there are the usual number of cracks and checks, but there is no doubt that blocks of large size may be quarried absolutely free from flaws, and that masses of marble may be produced larger by far than can be shipped from the quarry in single blocks. When connected with the railroad this property is destined to become valuable.

## SANTA CRUZ COUNTY.

The crystallized lime rock (marble) on Medar Creek, near the bridge on the county road, promises the best of any observed in Santa Cruz County, but the exposures are only those made in grading the road at the place mentioned. The marble occurs on both sides of the granite uplift, at an altitude of about 900 ft., extending in an almost unbroken line for 12 miles on the northwest side. On the east side the largest mass is only 2 miles long, lying between the Santa Cruz and San Vicente creeks. On the northeast it occurs in a considerable mass near the town of Felton, but it is not suitable for building material.

Within 2 miles of Santa Cruz City, in a N.W. direction, are a number of quarries of lime rock which is used for macadam, ashler, curbing,

and concrete foundations. The limestone is coarsely crystalline, and while a marble in fact, it is too loose grained, and from great movement and pressure has assumed a semi-schistose structure which causes it to scale off in slabs from the larger blocks. It is exposed to a depth of 25 ft. in one quarry, and is found resting on a glaucophane schist, somewhat crumbled and interstratified with limestone, probably the result of infiltration or replacement. Small bunches and irregular veins occur in the schist, containing finely disseminated iron sulphide, said to assay in silver a few ounces to the ton.

*I X L Lime Company* burned at the Felton kilns, in 1893, according to the Superintendent's report, 50,000 bbls. of lime, employing in the quarries, at the kilns, wood-chopping, teaming, etc., 50 to 55 men.

*Louis De Dero Quarry.*—It is  $1\frac{1}{2}$  miles N.W. from the business portion of Santa Cruz. During the summer months 20 men are employed at the quarry, and 20 to 25 more in teaming and other work indirectly connected with the quarry. Immediately under the limestone ledge, at its contact with the glaucophane schist, there are two large springs of beautifully clear water. As these springs are at an altitude of something like 200 ft. above the city of Santa Cruz, the supply could be utilized for water power.

*Santa Cruz Quarry.*—Near the above quarry, but a little N.W., is a quarry of coarsely crystallized carbonate of lime that makes a lime of good quality. Six kilns are in operation most of the time, giving employment to about 175 men; 8 to 10 men are employed in each of the working quarries, and a considerable number in transporting the rock to the kilns; a large number also in cutting, hauling, and handling wood, and still others in teaming between the storehouses at the kilns and the railroad.

*Thurber Quarry.*—This is situated in a field adjoining the De Dero quarry. This quarry employs 5 men at present, but a larger number of men find work during the summer months.

*W. T. Holmes Lime Company.*—This company has three continuous and seven ordinary kilns. In 1893 they burned 70,000 bbls. of lime, employing 12 men in the quarry, 30 about the kilns, and 40 in cutting wood, making staves, and in teaming; total, 82 men. None of the lime rock quarried here is used for other purposes than making lime. It is too much shattered for structural purposes and there is no demand for macadam. A branch railroad runs from the main line of the narrow gauge to the Holmes lower kilns and to the town of Felton for the economical handling of the lime.

#### SHASTA COUNTY.

*Backbone Creek.*—Near here is a deposit of limestone, where an excellent quality of lime is made.

*McCloud River.*—Great beds, almost 1 mile wide, are found between Squaw Creek and Pitt River, bearing N.W. up to McCloud River.

#### SOLANO COUNTY.

*Dicky's Quarry.*—On a ranch  $3\frac{1}{2}$  miles N.E. of Suisun is this quarry, the product of which is shipped and used for flux in the smelting furnaces at Vallejo Junction. It produced last year 5,060 tons, and is worked only during the summer months.



## SONOMA COUNTY.

*Geyserville.*—Limestone is found and has been quarried 7 miles N.W. from Geyserville, where two kilns were built. The lime, it is said, does not retain its white color, hence is unsuitable for plaster. The quarry is not being worked.

## TUOLUMNE COUNTY.

*Columbia Marble Company.*—It has opened several quarries  $2\frac{1}{2}$  miles from Columbia. The product varies in texture from extremely fine statuary marble to a rather coarse limestone; in color it ranges from white to nearly blue-black, some being mottled and some banded. It dresses well, has no detrimental inclusions of quartz, and takes a high polish. The cutting works are located at the quarries. At present, filling orders for local consumption constitutes the bulk of the business.

*Sonora Quarries.*—At several points near Sonora small quarries are opened, where a limited amount of marble is taken out and dressed for the local market.

## PAVING-BLOCKS.

## CONTRA COSTA COUNTY.

There are quarries in the hills between Concord and Clayton, about 6 miles N.W. of Mount Diablo, where formerly paving-blocks were made, but for several years past nothing has been done at these places.

## MARIN COUNTY.

*De Long Quarry.*—It is on the F. C. De Long estate, near Novato.

*Joseph Taylor Quarry.*—It is located near Novato, and was working 8 to 10 men in April, 1894.

*Paving-Block Quarry.*—It is near Green Brae, and was operated some time since, but work has been suspended for several years.

## SONOMA COUNTY.

The quarrying of paving-blocks is an important industry of this county, and gives employment to several hundred men even in ordinary times, while in a busy season more than a thousand men are employed. The principal quarries are near Santa Rosa, Sonoma, and Petaluma. The rock quarried for paving-blocks is erroneously called basalt. It is a dark gray trachyte, which covers 200 square miles of the eastern portion of this county. The lower portion is usually a heavy deposit of tufa of varying shades, though usually white. This succeeds in many places to a brick-red, porous, tufa-like rock, overlaid by massive, crystalline volcanic rock of dark-blue or gray color.

*Barnes Quarry.*—This is 2 miles E. of Penn's Grove Station. Two men are employed.

*Borg Quarry.*—It is near Melitta. There are 18 to 50 men employed. In 1893 this quarry shipped 240,000 blocks, and has now 6,000 on hand.

*Clute Quarry.*—It is E. of Santa Rosa. This quarry employs 20 men, who in 1893 made 150,000 blocks, of which 100,000 were marketed.

*Cooney Quarry.*—It is 5 miles N.E. of Petaluma. Two men are employed.

*Cronin Quarry.*—It is 1 mile S.E. of Petaluma. Worked intermittently.

*E. W. Davis Quarry.*—It is 2 miles E. of Penn's Grove, and employs 8 men.

*Dickinson Quarry.*—It is on the Dickinson ranch, 5 miles N.E. of Petaluma.

*Harney Quarry.*—It is between Santa Rosa and Melitta. From 7 to 25 men are employed. There were 65,000 blocks shipped in 1893, and 100,000 are now on hand.

*Landgren Quarry.*—It is between Santa Rosa and Melitta. Five men are employed. In 1893 there were made here 80,000 blocks, 20,000 being shipped.

*Lester Harding Quarry.*—It is 5 miles N.E. of Petaluma, and employs 2 men.

*Manuel's Quarry.*—This is one of a number of paving-block quarries situated along the line of the S. F. & N. P. R. R., between Santa Rosa and Kenwood Station. It employs from 20 to 30 men. In 1893 this quarry produced 400,000 blocks and shipped 100,000.

*P. Maramora's Quarry.*—This is at Kenwood, and employs 8 men. There were 60,000 blocks shipped in 1893, and 40,000 are now on hand.

*Maroni Quarry.*—Located at Kenwood. Six men are now employed, though at times a greater number. No blocks were shipped in 1893, but there are 40,000 on hand, which were about to be loaded on the cars in April, 1894.

*Pinelli Quarry.*—This is on the Vallejo estate, half a mile N.W. of the town of Sonoma, and produced in 1893 about 200,000 blocks. There are now on hand ready for shipment 130,000 blocks. This quarry also produces building-stone. In the spring of 1894 there were 6 men employed. At times in 1892 and 1893 about 40 men found work here.

*Roberts Quarry.*—It is 2 miles E. of Penn's Grove Station. There are 12 men employed.

*Schocken's Quarries.*—They are on a hill N. of Sonoma, overlooking the town, and are the largest in the district. There are employed at present 40 men, and at times 60 or more. These quarries in 1893 produced 600,000 paving-blocks, which were mostly shipped to San Francisco and Oakland.

*Stacy Quarry.*—Located at Kenwood, and is idle at present, though last year 20 men were employed. During that year 25,000 blocks were shipped, and there now remain on hand 150,000 blocks.

*Thomason's Quarry.*—It is owned by E. R. Thomason, of San Francisco, who employs 30 men. During 1893 over 300,000 blocks were made here, of which 100,000 were marketed.

*G. Violette's Quarry.*—This is at Melitta, but is not at present in operation. In 1893, 40,000 blocks were shipped; there are now on hand 100,000.

*Weyl Quarry.*—This is situated 1 mile N. of the town of Sonoma. Six men are employed at present, but at times 25 to 30 men find employment.

*Wilkinson Quarry.*—This is situated 2 miles E. of Penn's Grove Station, between Santa Rosa and Petaluma. At present it employs 3 men.

The price paid for these blocks is \$32 per thousand at San Francisco

for street blocks, and \$41 for a larger block known as the "specification" block. The cost of making the latter is \$18 to \$20 per thousand, and the transportation by wagon is \$3 to \$3 50 per thousand, and by rail \$16, making a total cost of about \$37 to \$39 50 per thousand. By this it will be seen that competition is close and the margin of profit small.

## SANDSTONE.

### COLUSA COUNTY.

*Sites Quarry.*—This is situated about three quarters of a mile E. of Sites. The plant consists of a Sargent and an Ingersoll drill, a steam channeler, two gang saws, and a hoist, all run by steam power. This quarry is said to furnish about 40,000 cu. ft. of dressed stone a month. Formerly known as the O'Neil & Abbot Quarry. See our XIth Report, p. 188. Sites Sandstone Company, of 315 Montgomery Street, San Francisco, owners; J. N. Burns, of Sites, Superintendent.

### CONTRA COSTA COUNTY.

*Martinez Quarry.*—Sandstone suitable for building is not abundant in this county, but on the ranch of James Rankin, at Martinez, is a stratum of sandstone which years ago was quarried to obtain the trimmings for the Napa Insane Asylum, and also for the construction of several buildings in Martinez, one of which is more than forty years old. It shows no deterioration by weathering, and is really a handsome stone. In color the rock ranges from buff at the surface to gray beneath, and finally shading into bluish-gray. It resembles the stone obtained in the Farwell Quarry, in Alameda County, near Niles Cañon. The rock is quite massive, and its appearance suggests the possibility of obtaining large-sized blocks at no great depth. The quarry has not been worked in many years, strange to say. Its close proximity to economical transportation by water would seem to make this quarry valuable. The rock is free, as far as observed, from flinty masses and inclusions of clayey material, while iron nodules are entirely absent.

*McNear's Quarry.*—This is on the line of the S. P. R. R., between Martinez and Port Costa, and not far from the Nevada Dock warehouses. There has been quarried a quantity of sandstone which was used in constructing two office buildings at Port Costa. An examination of the stone in the buildings showed it to be rather soft and to contain many small nodules of iron, which decay and fall out. This particular stone is not suitable for use in large buildings where great weight will come upon the lower portion of the walls.

*Oakland Rock Company's Quarry.*—A new concern has a quarry in this county about 10 miles N. of Oakland and a mile from the line of the California and Nevada Railroad. In April, 1894, crushing works, having a capacity of 300 cu. yds. per day, were being erected, very little work as yet having been done in the quarry. The material from this quarry will be used for macadam and concrete work. A force of 50 or more men will be required when the crushing plant is in operation.



## HUMBOLDT COUNTY.

*Jacoby Creek Quarry.*—This large sandstone quarry is in active operation, the rock being used for the breakwater at the mouth of Humboldt Bay. Last year 74,000 tons were shipped, mostly in pieces measuring more than a cubic yard in bulk. Arrangements have been made to take out 100,000 tons in 1894. There are 150 men employed; their average earnings are \$1 75 per day. Small portable hoists are used to move and load the rock.

## LAKE COUNTY.

*Middletown Quarry.*—For building purposes, suitable rock has been obtained from a low range of hills near Middletown.

## NAPA COUNTY.

Situated in Gordon Valley, 11 miles E. of Napa, is a dark gray, even-grained rock.

## SANTA CLARA COUNTY.

There are several quarries 7 miles from San José, on the branch railroad running to New Almaden. The station is called Graystone. The rock from these several quarries is similar, being a rather coarse-grained, buff to yellowish-gray stone, the better quality of which makes a handsome and apparently durable building-stone.

*Flynn Quarry.*—It is on the Seales estate,  $2\frac{1}{2}$  miles above Hillsdale, on a branch of the New Almaden line. It has never been opened extensively. The stone is of good quality, however, and will no doubt in time become valuable.

*Gay Quarry.*—It is 3 miles S. of San José. The rock quarried here is partly in the form of rectangular paving-blocks, and partly broken rock for macadam. There are 12 men employed at present.

*Goodrich Estate Quarry.*—This is the largest quarry and the only one working at present, and is commonly known as the *Graystone Quarry*. The works consists of two gangs of saws; the cutting and finishing department is at the station. The quarry is half a mile distant, on a spur track. The stone lies in quite uniform stratum, 10 to 18 ft. in thickness, dipping  $15^{\circ}$  to  $20^{\circ}$  S.E. During 1893 about 18,000 cu. ft. of stone were quarried, furnishing stone for the new Post Office in San José, the Oakland High School, and the Moir Block in San José. At the quarry 10 to 20 men are employed as required. At the works about 20 men are employed constantly.

*Stanford Quarry.*—It is just below Graystone Station, at the side of the railroad. It is a portion of the Goodrich estate, which was leased to Senator Leland Stanford, who took from it all the stone used in constructing the handsome Stanford University buildings. It has not been worked for more than two years.

*Western Granite Company.*—They opened a quarry about 2 miles above Hillsdale Station some time ago, and spent several thousand dollars in equipment. They quarried the stone used in the Ryland Block in San José, but finding that the stone did not come up to expectation abandoned the quarry.

## SAN MATEO COUNTY.

*Brittan Ranch.*—Three miles N.W. of Redwood, and 1 mile from the railroad, is a quarry of the blue sandstone common along the Coast Range. It is highly metamorphosed. The quarry has been opened to furnish rock for building walls, chimneys, etc., and for concrete and macadam. It was not operated at all in 1893. On an eminence between the sandstone quarry and the railroad a quarry has been opened in the flint rock. This rock has also been used in making concrete, walls, and foundations.

## SOLANO COUNTY.

In *Tolenas Cañon*, half a mile below the mineral springs, there are boulders and croppings of a dark-colored sandstone which has every appearance of being suitable for building-stone, though at no place has a quarry been opened. Several pedestals are standing on the lawn at the Tolenas Springs House, which have been artistically cut and dressed, and which, it is stated, were made from boulders found at the place indicated; these monuments have stood there several years, and show no sign of decay from exposure to the weather.

## SONOMA COUNTY.

*Coast Bluffs.*—Along the bluffs on the coast from Fort Ross to Stewart's Point, sandstone has been quarried and proved a good building material; the bluffs can be approached by schooners.

## SLATES.

Although there are extensive belts of slate throughout the State, some of which can be used with advantage for the purposes where in the building trade, or arts, slate is desired, the only developments to date of such deposits are in El Dorado County. There the quality of the material is of the very best.

## EL DORADO COUNTY.

A blue-black, finely laminated slate strikes through this county with a general N.E. and S.W. course, standing nearly vertical, and closely following the "Mother Lode." It has been mostly developed along Big Cañon, that runs north down to Chili Bar, and has been traced across the Georgetown Divide to the vicinity of Volcanoville. The peculiar features of this slate are its extreme elasticity, and the fact that it has no developed fracture planes, further than its extremely fine grain, and also that after a forty years' test it is found to retain its original color with no signs of fading. In proof of its extreme elasticity, squares of slate split seven to the inch, and 18 in. square, have been fastened solid at the two ends and bent in the center 3 in., without showing the least sign of a fracture.

*Chili Bar Slate Quarry.*—This quarry is 3 miles N. of Placerville, in Sec. 36, T. 11 N., R. 10 E., and contains 40 acres of patented ground

facing the river, on the stage road between Georgetown and Placerville, at the Chili Bar bridge. The quarry presents a bluff facing the river 600 ft. in length and 200 ft. high, with an available belt of clear slate 97 ft. wide. At the east side the slate is traversed by small quartz seams. By the present mode of working, an average of 15 tons of slate have to be moved and handled to furnish 1 ton of marketable slate, but with improved appliances this waste will be greatly reduced. This waste can, by suitable appliances, be converted into a very good quality of bricks. The average present production is 1,200 squares per year. (A "square" signifies 10 by 10 ft.) The usual sizes produced are 12 by 6 in. up to 12 by 24 in., split five to the inch. In blasting the slate, a very slow-burning, coarse-grained powder is used, the holes being drilled at right angles to the splitting surfaces of the slate. The product from this quarry goes to the principal towns in the State. Ten men are employed. See our VIIIth and IXth Reports, pp. 199 and 283. J. G. Mothersole, of Placerville, owner.

*El Dorado Big Tunnel Company.*—This is really a gold mine, in which in driving a main tunnel they cut through the same belt of slate as that of the Chili Bar Slate Quarry. The available slate is 97 ft. wide, and at 250 ft. vertical depth from the surface shows an extremely fine texture. Steps are to be taken to work this slate body in connection with the mine. El Dorado Big Tunnel Company, owners; G. W. Campbell, of Placerville, Secretary.

*San Francisco Slate Company.*—This company controls 640 acres on the north side of the river, opposite Chili Bar. The quarries are in T. 11 N., R. 10 E., at an elevation of 150 ft. above the river. Two pits are being worked. The older pit is worked on a system of three benches of about 70 ft. face. An Ingersoll channeler for undercutting and two Ingersoll-Sargent machine drills are used; a compressor, run by water power from Kelsey Cañon, with a 250 ft. fall, using 40 in. of water, furnishes the required power. A large derrick used to handle the channeler, and a smaller one for handling the rocks, receive power from the same source. About 600 ft. of tramway connects the quarry with the two cutting machines. On the floor of the upper bench is a wire saw with an endless wire 1,400 ft. long. The second pit, situated one fourth of a mile up the river, has been but recently started and is at present 30 ft. deep. These works employ 23 men. San Francisco Slate Company, owners; J. R. S. Kymersley, of San Francisco, President.

*El Dorado County slate* is used on the following and other buildings:

At Bakersfield: New railway station and round-house.

At Berkeley: Deaf and Dumb, and the Blind Asylum.

At Glen Ellen: Home for Feeble-Minded Children.

At Ione: Preston School of Industry.

At Los Angeles: Whittier State School, and two large buildings.

At Napa: Masonic Hall, and new part of the State Asylum for Insane.

At Oakland: St. Mary's College; four school-houses; three churches; five private houses, and two buildings in Mountain View Cemetery.

At Ogden, U. T.: Union Depot.

At Portland, Or.: Three large commercial buildings.

At Sacramento: U. S. Government Building; Western Hotel; Buffalo Brewery, and five private houses.

At San Francisco: Buildings of the San Francisco Gas Company; Lick Baths; California Hotel and Theater; five churches; Cooper



Medical College; Lane Hospital; High School; block corner Mission and East Streets.

At San José: Hall of Records; State Normal School; one church, and one private house.

At Santa Barbara: One church.

At Stockton: Three churches; Court-house and Hall of Records, and two private houses.

By S. P. Company: Five large stations.

At Ukiah: State Asylum for Insane.

At Woodland: Two commercial buildings.

Private houses in Menlo Park, Merced, Woodland, Placerville, etc.

## STEATITE AND SERPENTINE.

### AMADOR COUNTY.

Serpentine is quarried near the Ione and Plymouth road,  $1\frac{1}{2}$  miles W. of the Central House, where a broad belt of serpentine striking N.W. crosses the road. Near the central area the rock seems to have preserved much of its original crystalline structure. In color the rock is yellowish-green to dark olive-green and brownish. It has a fine granular texture and takes a good polish. The quarry pit is only 40 by 20 by 15 ft. No work is in progress at present. Owned by Dr. Thomas Boysen, of San Francisco.

### LOS ANGELES COUNTY.

*Empire Landing Quarries.*—These quarries are situated in the valley of the Pots, on Santa Catalina Island. The rock is steatite, and takes a fine polish. There are two varieties—a hard and a soft. The soft variety is sawed into slabs of any length. The hard variety is worked with ordinary stonecutter's tools. Two men are employed in this quarry. This stone has been used in several buildings in Los Angeles for ornamental, sanitary, and electrical purposes, also for lining fire-places and furnaces. The sanitary and electrical insulators manufactured from this stone are said to give the greatest satisfaction. The soft variety is supplied in slabs 1 in. in thickness, f. o. b. at Los Angeles, for 75 cents a running foot. The hard variety can be supplied in similar slabs at the rate of \$2 50 a running foot.

*Santa Catalina Island.*—There is a large body of steatite on this island. It is said that about 400 tons of this rock is supplied every year to plasterers, soap factories, druggists, and foundrymen.

### TUOLUMNE COUNTY.

Steatite is quarried at numerous places in this county, but so far only for local use. It has been used for foundations for boilers and in building chimneys, and at Chinese Camp for the walls of buildings.



Recent Travertine Deposit, Mono County.



Main Fissure of the Travertine Deposit.





## TRAVERTINE AND ONYX.

## MONO COUNTY.

*Travertine and "Onyx."*—This deposit is situated about 1 mile S.E. of Bridgeport, and near the base of an extensive area of hilly country formed of hornblende andesite. Here four claims have been located in one block, but the most of the travertine is confined to two of them. The springs, which at one time were more numerous than at present, have built up a deposit of unknown depth, in what is apparently a basin-like depression; a large part of this mass consists of porous limestone, but in the center and eastern part deposits of a different kind have been formed. Here are eight distinct moles or ridges, seven of them nearly parallel, and built up from 10 to 25 ft. above the general level. Running longitudinally through each of these, and generally nearly vertical, is a fissure, sometimes open and nearly 2 ft. wide, and at others closed by a deposit of banded onyx (aragonite) or travertine. The outer portion of these ridges is formed generally of a somewhat shelly and porous lime deposit. The open cavities sometimes have a depth of 15 ft., and in them can be seen to advantage the character of the travertine. It would appear that the springs which carried the lime, magnesia, iron, etc., which was deposited to form the ridges were generally arranged along parallel fissures in the underlying rock. In places it would seem that as the ridges were built up the central fissure grew wider, and the deposition terminated with the filling of this central cavity by the travertine. In nearly all cases the travertine was formed in the vertical fissure, while the shelly layers of the lime adjoining were nearly level, sloping off on either side. One mole is still in process of formation. Numerous springs, varying in temperature from lukewarm to boiling, are scattered irregularly over the spaces between the ridges, but do not leave any deposits near their orifices, the lime and magnesia in the latter case not being precipitated immediately on reaching the surface. The outer portions of a number of the moles have been partly worn away. In one or two there are considerable quantities of magnesia and soda; the travertine in the center, being much harder, is not so easily eroded. The extent of the travertine and onyx is evidently considerable; no work has yet been done to show the depth to which they reach. In places it would appear that it must be more than 50 ft. Near the eastern edge of the deposit is a spring slightly impregnated with carbonic acid, the water being very pleasant to the taste. The great beauty of the travertine found here will undoubtedly bring a large amount of it into use. California Travertine and Onyx Company, of Bridgeport, owners.

## SAN LUIS OBISPO COUNTY.

The so-called onyx deposits are described in our Xth Report, p. 584. No developments have been made since.

## SOLANO COUNTY.

At *Tolenas Springs* occurs an extensive deposit of aragonite, locally called onyx, which is a calcareous travertine deposited from the mineral springs which abound in the neighborhood. Some of this rock is honeycombed from the action of carbonated water.

## TRACHYTE, TUFA, AND VOLCANIC ASH.

## AMADOR COUNTY.

Volcanic ash is used somewhat in building, but no quarries are regularly worked. Both white and red tufa are quarried in the Jackson Butte, 2 miles S.E. of Jackson.

## CALAVERAS COUNTY.

Volcanic ash is quarried in a score or more places in this county. So abundant is good material of this description that quarries are opened at the nearest convenient places. There are several of these quarries about Altaville, and on the road from Angels to Vallecito and Murphys. This stone caps the channels of the ancient rivers, and is a volcanic ash, in which a process of crystallization has taken place. The rock varies in texture from a somewhat spongy, though firmly coherent, mass, easily dressed or sawed, and making a fine building-stone, to that having a fine-grained, felsitic texture, and ringing like pottery. That which is a medium between the two is preferred. It is fire-proof, and weathers well, and withstands moderate pressure. Some of the finest buildings in Angels, San Andreas, and Mokelumne Hill are constructed of this material.

## LOS ANGELES COUNTY.

*The Lang Quarry* is situated on Santa Catalina Island. It is said that although this stone is admirably suited for building purposes, the greatest demand for it has been as rubble rock, for use in railroad construction and harbor improvements. It is stated that 150,000 tons of this rock have been used during the last fifteen years. This rock can be supplied f. o. b. at Los Angeles, at the rate of from \$3 to \$4 a cubic yard.

## NAPA COUNTY.

Trachytic tufa is quarried in various places on the east side of Napa Valley for building purposes; also near Calistoga.

## SONOMA COUNTY.

*Agua Caliente Quarry.*—Near Agua Caliente Post Office is a deposit of light-gray tufa, which has been used in the construction of local buildings, but not elsewhere, as far as was learned. It resembles the white tufa half a mile N. of the town of Sonoma, and is a portion of the same deposit. W. R. Cady, of Agua Caliente, owner.

*Freestone Quarry.*—Here a white ashy tufa occurs which has wrongly been named "freestone." A quarry was opened years ago on the ranch of James Kane, but the rock has only been used locally. The rock exposed to-day in the quarry is too soft for building-stone. The quarry has not been operated for years, and never except in a desultory way to supply the spasmodic local demand. James Kane, of Freestone, owner.

*Maroni Quarry.*—Near Kenwood Station, between Sonoma and Santa Rosa, a red lava occurs, which furnishes the rock for the Kenwood rail-

road station. Some of this rock has also been shipped to San Francisco. P. Maroni, of Kenwood, owner.

*Stony Point Quarry.*—A white tufa occurs near Stony Point, between Santa Rosa and Petaluma. It has been used in facing two buildings in Petaluma. The rock can be sawed when first quarried, but hardens on exposure.

*Vallejo Estate Quarry.*—On the ranch of the Vallejo estate, half a mile N. of the town of Sonoma, is a quarry of dark-red porphyritic rock, which has been used locally for building purposes. The rock is scarcely suitable to be used in the construction of tall buildings when great pressure and strain are likely to occur. The quarry also produces paving-blocks. There are 5 men employed at present; at times as high as 40 men have been at work in this quarry. A. Pinelli, of Sonoma, lessee.

Half a mile N. of the town of Sonoma is a deposit of light ashy tufa, which has been used locally for buildings, for curbing in the cemetery, and for rough walls. It is too soft to make good building-stone.



## MISCELLANEOUS.

## ASBESTOS.

## SIERRA COUNTY.

*The American Excelsior Consolidated Asbestos Company.*—This property is situated on Goodyear Creek, half a mile W. from Goodyear Bar. There are five claims comprised in the property. This belt has a N. and S. course and has been traced for over a mile. The fiber in places can be obtained from 5 to 6 in. in length.

## BARYTA.

## SANTA BARBARA COUNTY.

A deposit of baryta occurs on the Sisquoc, about 15 miles S.E. of Santa Maria. No work has been done, and the extent and quality are not known.

## DIATOMACEOUS EARTH.

## LOS ANGELES COUNTY.

There is said to be a deposit of diatomaceous earth, about 75 ft. in thickness, on Santa Catalina Island. A few tons of this material have been sold to druggists.

## EMERY.

## SIERRA COUNTY.

*Brandy City.*—Near here, in Sec. 1, T. 19 N., R. 8 E., emery is found in bunches, but not in a continuous body. The difficulty of freighting hinders any active explorations for this mineral.

## MINERAL PAINT.

## SONOMA COUNTY.

*Indian Metallic Red Paint Mine.*—This is  $7\frac{1}{2}$  miles S.W. from Healdsburg, on Porter Creek, and comprises 160 acres of mineral land and a 40-acre mill site. The ore body, consisting of hematite and silicate of iron, has a N. of E. course, and crops out 60 ft. in width. The walls are a hornblendic rock with actinolite and mica schist, with rotten ser-

pentine on the foot-wall. A tunnel 70 ft. below the croppings has been driven 175 ft. to the vein, which it cuts, disclosing a solid mass of peroxide and silicate of iron, which is crushed, ground, and bolted in a mill supplied with four burrstones. About 8 tons of ore are worked per day, making a paint fit to mix with oils or japan. Steam power is used. Ten men are employed when running full handed. The ore assays from 60 to 75 per cent of iron. C. Merchant, of Healdsburg, owner.

## YUBA COUNTY.

*Mott's Ranch.*—A ledge of mineral paint (red) has been found 6 miles N.E. from Brown's Valley, between Pain's Peak and Labadie Peak; it has a N. and S. course, and consists of peroxide and silicate of iron. The extent of the material has not been demonstrated; it crops out and is cut by a ditch on Mr. H. Mott's land.

The soil through this section of country shows the presence of large quantities of peroxide of iron.

## NATURAL CARBONIC ACID GAS.

## SANTA CLARA COUNTY.

*Carbon Dioxide at New Almaden.*—All are familiar with natural illuminating gas and its economic value, but it is only recently that the much dreaded choke-damp of coal miners—carbonic acid gas ( $\text{CO}_2$ )—has been turned to a valuable use in this State. This gas exists in greater or less quantity in nearly all mines, and more particularly in old workings. In a portion of the New Almaden Quicksilver Mine it is very abundant, and at the time the openings referred to were made, the flow of gas was so abundant that that portion of the mine was abandoned. This gas occurs in the Santa Isabel shaft and in a drift leading off from it. The shaft was sunk vertically 575 ft., and from that level a drift was run in 2,150 ft. The  $\text{CO}_2$  was always troublesome, but as the distance from the shaft increased, the gas became stronger and stronger, until it was with difficulty the miners could work. At the face, 2,150 ft. from the shaft, a blast opened a reservoir of the deadly gas, which rushed in upon the miners, who were obliged to retreat before it. All ordinary means of getting rid of the gas having failed, a powerful air compressor was located at the shaft on the surface, and a vast volume of fresh, pure air was forced down into the mine, while at the same time an exhaust blower was draining the foul gas from the drift, but to no purpose. Lights would not burn and men could not live there, and the work was abandoned. At a point 845 ft. distant from the shaft a bulkhead of brick was built, the walls being double and 2 ft. apart. The middle space was filled with cement. A pipe was laid in this wall for experimental purpose probably. Recently an enterprising soda water manufacturing concern of San José has taken a long time lease on this reservoir of natural carbonic acid gas, and is now using it in the manufacture of mineral waters, ales, etc., and is also selling it to breweries. The gas is drawn from the pipe and forced into a large receiver, from which it is charged into steel cylinders, under a pressure of 1,300 lbs. to the square inch. The contents of one of the cylinders is equal to 1,200 gallons. In

this form the gas is shipped to any desired point. The cost is far below that of manufactured gas, evolved by the action of dilute sulphuric acid on marble dust. California Natural Carbonic Gas Company, of San José, lessees.

### PECTOLITE.

#### TEHAMA COUNTY.

A deposit of this mineral is found in Sec. 16, T. 25 N., R. 7 W., M.D.M. This mineral deposit is situated at the contact of the serpentine and metamorphic shale. There are several outcropping masses, which appear to be distributed along a line which has a N.W. strike; one of these masses measures 8 by 10 by 20 ft. Much of this rock is white, and shows a slightly fibrous structure, and some of it appears to be intermixed with country rock. See also our Xth Report, p. 692.

### PLATINUM.

#### PLUMAS COUNTY.

Platinum, with iridium and osmium, has been found, in small scales and grains, in conjunction with the gravels along Spanish Creek, Gopher and Badger Hill hydraulic mines; also in the gravel deposits of La Porte, and at Mumford, Shores, and Gopher hills, a few miles W. of Quincy.

#### TRINITY COUNTY.

It is found in small quantities in the gravel channels along Trinity River, more especially on the second bench. Also in small quantities in the gravels on Grizzly Gulch.

### SALT.

#### ALAMEDA COUNTY.

The salt industry in the vicinity of Alvarado and Newark, on the east side of San Francisco Bay, was established in 1869, and is now one of considerable importance, the output reaching many thousand tons per annum, and giving employment to 120 men during summer months and about 20 the year around.

The process of salt-making, as practiced here, has been described in our VIIIth Report, p. 32. The method pursued at Plummer Bros.' Works being similar in all essential particulars to that of the others, it only will be described.

Originally the salt ponds or reservoirs were simply lagoons or indentations in the marshy coast of the bay. Across the inlets to these, embankments or dikes were constructed, being furnished with gates which could be opened or closed at pleasure. The interior portion was subdivided into several basins. The outer gates are opened with the incoming tide and closed at the flood, the receiving reservoirs being



full. From these large ponds, 50, 55, and 60 acres, respectively, the water is pumped by windmills into an interior pond, having an area of 40 acres, but of greater depth than the others. The receiving reservoirs are filled once a month. The water evaporates rapidly during the summer months, being assisted by a brisk wind which is almost constant at that point. When by evaporation the water has attained a certain density, it is pumped into a receiver, called the pickle lake, from which it is pumped later into the smaller lakes and vats, where the solution becomes saturated and salt is deposited. The liquor, called "bittern," is then drawn off and the salt shoveled out by the workmen and placed in large heaps under roofs in lots of 800 to 1,000 tons. The salt made here is very pure. The coarsely crystallized mineral is ground to varying degrees of fineness, depending on the purpose for which it is to be used. Table salt is ground very fine; that sold to packing-houses is quite coarse. A large amount of the bay salt is sold to the chlorination works in the gold-mining region of the State.

## COLUSA COUNTY.

*The Antelope Crystal Salt Company.*—This was incorporated in 1890 to manufacture salt from brine springs on the Petersen ranch, near Sites. See our XIth Report, p. 180. The plant consists of 58 wooden tanks, 10 by 10 ft. by 6 in. deep, and 28 wooden tanks 10 by 10 ft. by 8 in. deep. Only a few tons of salt were manufactured in 1893 for local use. During June and July, 1894, Mr. Rusche, who leased the plant, manufactured several tons of salt. E. A. Harrington, of Colusa, manager.

## RIVERSIDE COUNTY.

*New Liverpool Salt Company's Works* are near Salton, a station on the S. P. R. R., in the Colorado Desert, 155 miles S.E. of Los Angeles. The salt is obtained from the natural evaporation of the waters of Salton Lake, the mineral being scooped up and housed. A grinding-works and store-houses constitute the plant. See our Xth Report, p. 388. The New Liverpool Salt Company, of San Francisco, owners; G. W. Durbrow, Superintendent.

## SAN BERNARDINO COUNTY.

*Danby Salt Mines.*—They are 30 miles S. of Danby, a station on the A. & P. R. R. The mineral occurs as rock salt of fine quality, the crystals being large and transparent. The salt is mined and hauled to Danby by steam wagons and shipped by rail. The mines comprise 160 acres. Crystal Salt Company, of 303 California Street, San Francisco, owners.

## SODA.

## INYO COUNTY.

*Inyo Development Company.*—The works of this company are situated on the shore of Owens Lake, 1 mile N. of Keeler. At the time of the Bureau's examination little work was going on, but during the summer a large body of men are employed. The method of obtaining the soda

from the waters of the lake was described by Mr. Goodyear in our VIIIth Report, p. 227. Inyo Development Company, of Carson, Nevada, owners.

## SULPHUR.

Although there are several deposits of sulphur in California, at present there is no sulphur being mined in the State, owing to the cheapness with which a comparatively pure article is imported as crude Japanese sulphur.

### COLUSA COUNTY.

*Sulphur Creek.*—There are deposits of sulphur both on the Moore property and at the Elgin Mine, in the Sulphur Creek Mining District.

### KERN COUNTY.

*Sunset Oil District.*—In the Sunset Oil District, on the western side of Kern County, there are deposits of sulphur which altogether cover an area of several acres. Prospect workings which are 10 or 12 ft. deep have shown that these deposits are made up of both high- and low-grade sulphur ore. Some of it is nearly pure sulphur, but for the most part it consists of drift cemented with sulphur, or decomposed rock or earth permeated with sulphur. All these deposits are acid, and bituminous matter is associated with some of them. See our XIth Report, p. 233; also Bulletin No. 3, p. 34.

### LAKE COUNTY.

*Sulphur Banks Mine.*—Sulphur was obtained in this vicinity in large quantities, but is not mined at present.

## WATER.

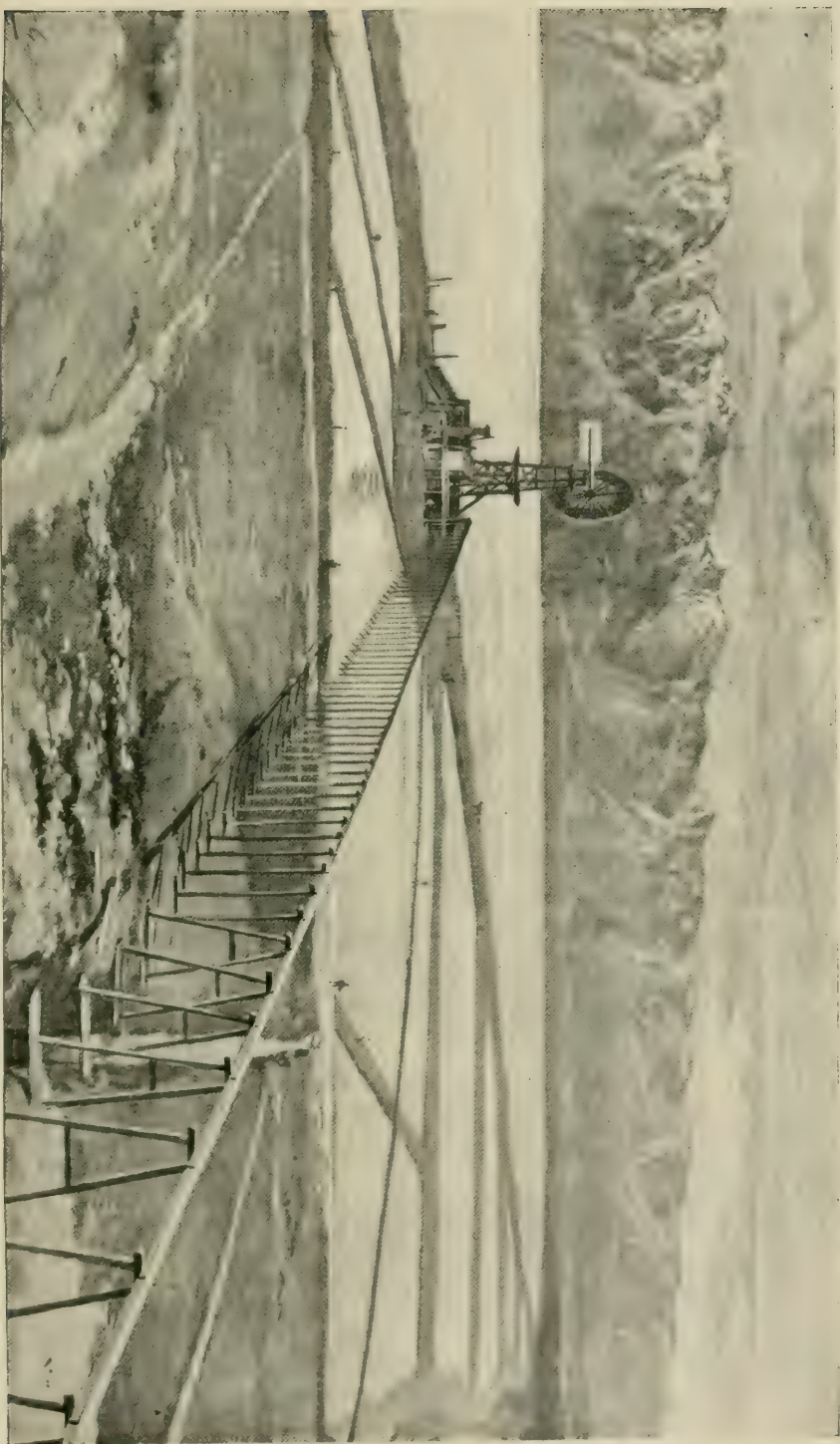
### SACRAMENTO COUNTY.

*Folsom Water Power Company.*—The dam and power-house and the first section of the canal, mentioned in our IXth and Xth Reports, pp. 336, 511, and 512, have been completed. Wm. Knight, the resident agent of this company, states that the canal has been nearly completed, the distance being 9,100 ft. below the dam, with a cross-section of 8 by 45 ft. The canal and fore-bay are expected to be completed soon, and waterwheels and electrical generators placed in position early next year, the electrical current to be used for light, power, etc., in Sacramento.

### STANISLAUS COUNTY.

*Irrigation.*—In 1893 a dam was built on the Tuolumne River by the Turlock and Modesto irrigation districts; it is of stone, 105 ft. high, and 310 ft. long on top.

*Modesto Irrigation District.*—The main ditch of this district has been completed from the dam to the eastern boundary of the irrigation district, a distance of nearly 23 miles. The head works and flumes



Owens Lake, Inyo County, showing Soda Evaporating Basins.





between the dam and Mill Gulch, a distance of about 4,000 ft., were to be completed this year. See our XIth Report, pp. 467 and 468.

*Modesto Waterworks.*—Owing to the fact that the old waterworks were situated in the most populous part of Modesto, new waterworks, owned by the city, have been established in the western outskirts of the town. At these works a shaft was sunk to the depth of 33 ft., in the bottom of which three wells were bored to a depth of 195 ft. below the surface of the ground. These wells are cased with 16 in. casing to a depth of 40 ft. from the floor of the shaft, and with 12 in. casing from the floor of the shaft to the bottom of the wells. The space between the 16 in. and the 12 in. casings is filled with cement. The water stands in the casing at a depth of 2 ft. below the floor of the shaft. It is said that continuous pumping lowers the water 24 ft., at which depth the water is stationary, although 700 gallons of water a minute have been pumped from the wells. Quicksand somewhat impedes the pumping. The pumping plant consists of two Hall's compound duplex direct-acting steam pumps, each of which is of 1,000,000 gallons nominal, and 800,000 gallons actual capacity for twenty-four hours. The pumps are run by a 40 horse-power engine and two 70 horse-power boilers.

*Turlock Irrigation District.*—The main ditch of this district has been finished for a distance of about 21 miles, and contracts have been let for the completion of the system. In July, 1894, about 200 men were employed. See our XIth Report, p. 467.

#### YOLO COUNTY.

A proposition is on foot to organize three irrigation districts in Yolo County under the "Wright Act." The water is to be obtained from Clear Lake, in Lake County.

#### ZINC.

#### SHASTA COUNTY.

*Hobbs Mine.*—This is 6 miles S.W. of Round Mountain. The vein courses E. and W., dipping about 60° S., between slate and granite walls. The ore body is in places 35 ft. wide, and contains finely divided zinc-blende, giving the ore at first glance the appearance of a granitic rock; it also carries some gold.

## GOLD TABLE

Showing the Proportionate Weight of Gold in a Mass of Auriferous Quartz when the Specific Gravity is known.

Specific Gravity.	Proportion of Gold.	Specific Gravity.	Proportion of Gold.	Specific Gravity.	Proportion of Gold.
2.60	0.0000	4.20	0.4413	7.20	0.7402
2.65	0.0219	4.30	0.4580	7.40	0.7515
2.70	0.0429	4.40	0.4739	7.60	0.7622
2.75	0.0632	4.50	0.4892	7.80	0.7724
2.80	0.0828	4.60	0.5037	8.00	0.7820
2.85	0.1016	4.70	0.5176	8.50	0.8042
2.90	0.1198	4.80	0.5310	9.00	0.8239
2.95	0.1375	4.90	0.5438	9.50	0.8415
3.00	0.1545	5.00	0.5561	10.00	0.8573
3.10	0.1869	5.10	0.5679	10.50	0.8717
3.20	0.2172	5.20	0.5793	11.00	0.8847
3.30	0.2458	5.40	0.6007	11.50	0.8966
3.40	0.2726	5.60	0.6206	12.00	0.9075
3.50	0.2979	5.80	0.6392	13.00	0.9268
3.60	0.3218	6.00	0.6565	14.00	0.9434
3.70	0.3444	6.20	0.6727	15.00	0.9577
3.80	0.3659	6.40	0.6879	16.00	0.9703
3.90	0.3862	6.60	0.7021	17.00	0.9813
4.00	0.4055	6.80	0.7156	18.00	0.9912
4.10	0.4239	7.00	0.7282	19.00	1.0000

## METHOD OF DETERMINING THE RESPECTIVE QUANTITIES OF GOLD AND QUARTZ IN QUARTZ SPECIMENS.

$$\frac{\text{Sp. g. Nugget} - \text{Sp. g. Quartz}}{\text{Sp. g. Gold} - \text{Sp. g. Quartz}} \times \frac{\text{Sp. g. Gold}}{\text{Sp. g. Specimen}} \times \text{Weight of Nugget} = \frac{\text{Weight of Gold in Specimen.}}{\text{Weight of Gold in Specimen.}}$$

$$\frac{\text{Sp. g. Gold} - \text{Sp. g. Specimen}}{\text{Sp. g. Gold} - \text{Sp. g. Quartz}} \times \frac{\text{Sp. g. Quartz}}{\text{Sp. g. Specimen}} \times \text{Weight of Specimen} = \frac{\text{Weight of Quartz in Specimen.}}{\text{Weight of Quartz in Specimen.}}$$

*First Example.*—Suppose we have a specimen weighing 1,000 grains, and its specific gravity is found to be 8. Suppose, also, the specific gravity of gold were 18, and that of quartz 2, then, by above rule:

$$\frac{8-2}{18-2} \times \frac{18}{8} \times 1,000 = \frac{6}{16} \times \frac{18}{8} \times 1,000 = 843\frac{3}{4} \text{ grains of gold in specimen.}$$

$$\frac{18-8}{18-2} \times \frac{2}{8} \times 1,000 = \frac{10}{16} \times \frac{2}{8} \times 1,000 = 156\frac{1}{4} \text{ quartz in specimen.}$$

*Second Example.*—Nugget weighing 10 oz.; Sp. g. nugget,  $8\frac{1}{2}$ ; Sp. g. gold, 19; Sp. g. quartz,  $2\frac{1}{2}$ :

$$\frac{8\frac{1}{2} - 2\frac{1}{2}}{19 - 2\frac{1}{2}} \times \frac{19}{8\frac{1}{2}} \times 10 = \frac{6}{16\frac{1}{2}} \times \frac{19}{8\frac{1}{2}} \times 10 = 8.1283 \text{ of gold in specimen.}$$

$$\frac{19 - 8\frac{1}{2}}{19 - 2\frac{1}{2}} \times \frac{2\frac{1}{2}}{8\frac{1}{2}} \times 10 = \frac{10\frac{1}{2}}{16\frac{1}{2}} \times \frac{2\frac{1}{2}}{8\frac{1}{2}} \times 10 = 1.8716 \text{ quartz in specimen.}$$



## ELECTRIC POWER TRANSMISSION PLANTS AND THE USE OF ELECTRICITY IN MINING OPERATIONS.

By THOMAS HAIGHT LEGGETT, of Bodie, Mono County, California.

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Some one has aptly spoken of California as the Switzerland of America. Certainly the rugged scenery of its snow-capped Sierra, and its numerous lakes and mountain streams, justify, in part, the simile. In Switzerland they have been quick to realize the advantages to be derived from the utilization of their water powers for the generation of electric power, and its transmission to distant points; here, in California, we are but beginning to grasp the situation.

In electricity the miner has undoubtedly gained a most efficient and valuable ally. Through its aid the latent power of the many streams now running idly down the mountain slopes can be made available, and brought across long stretches of country by means of a simple line of wire, to operate the machinery of mine and mill.

In sections where no water powers are available, and fuel is scarce and dear, electricity may be generated at the center of fuel supply, and the power transmitted from this central station to operate a number of mills and hoisting works in the distant mining camp. One of the great advantages of electric power is its adaptability to ready subdivision into small units without material loss of power, by reason of the high efficiency now developed by the best types of dynamos. Hence, separate motors may be used in the mill for running crushers, stamps, concentrators, pans, etc., or in the mine for hoisting-engines, pumps, and air compressors, effecting a very appreciable saving when any of these machines are idle. To accomplish this requires the use of the direct current, but this can be readily obtained from the alternating where such is used for the transmission, by employing rotary transformers, or "motor generators," of high efficiency.

In a letter to the writer, accompanying photographs illustrating the Telluride, Colo., transmission plant, hereinafter described, Mr. Chas. F. Scott gives the following excellent résumé of the present status of electricity in the field of mining:

"In the introduction of electrical apparatus to the operations of the mining industries of the West, the field of electrical power transmission is extending upon lines which have already been well established in other industries. The electric motor is becoming an important factor in almost every industry in which power is utilized. One of the most notable instances is in electric traction. The electric street railway motor has not only almost entirely replaced animal power, but it has wonderfully increased the speed, comfort, and economy of street railway operation, and has also extended it to distances and classes of service which were previously impracticable. The early railway motor had many and peculiar difficulties to overcome, but the problems incident to it have been rapidly surmounted.

"Results similar to those which have been attained in street railway working are to be anticipated in the application of the electric motor

to the mining industry. Not only will the work which is now performed be done in many cases with increased ease and economy, but the introduction of the motor will lead to new methods of operation. Mining possesses many difficult and peculiar requirements for the application of power. The motor, on the other hand, possesses characteristics which render it capable of being adapted to a very great variety of conditions.

"The work which has already been accomplished in the new plants which have been installed, promises much for the future. The first work has been under difficulties which are incident to every new undertaking. The principal difficulties which have manifested themselves are, however, not fundamental ones; they are principally due to mechanical difficulties which are more or less readily recognized, and usually indicate a ready method of solution. A second trouble, which has promised at times to be very serious, is the effects resulting from the atmospheric conditions in the mining country. Lightning in many places has been extremely severe, and methods of protection were required which were impossible to devise before the conditions had been learned from experience. The necessity for protection has been followed by the means of protection, and electrical installations need no longer be in peril from lightning, if properly protected.

"The experience and progress which have come from other applications of electricity can be taken advantage of in application to mining work. The constant improvements and advances which are being made in the manufacture of electrical apparatus make it possible to secure at the present time apparatus which is better adapted for its work than could have been secured a few years ago.

"There is often an apprehension, on the part of those who are not familiar with electrical apparatus, that it is a fundamental failure if it does not at once begin and continue in satisfactory operation. Those, however, who are acquainted with electrical machinery, and who understand the nature of the difficulties which develop, may readily see that the fundamental elements in electrical power transmission and distribution are not involved in these difficulties, but that they arise from incidental features which can be readily corrected. The work which has already been accomplished shows the possibilities which are open in the field of electrical mining, and promises much for the future."

The transmission of 100 horse-power a distance of 109 miles, from Frankfort to Lauffen, Germany, in 1891, showed conclusively that from an engineering standpoint, at least, the transmission of power over long distances by electricity was perfectly practicable; though in this particular instance it was not a commercial success, nor was it intended to be, since the power was used for exhibition purposes only. Since then, however, plants have been installed both in Europe and in the United States, and are to-day successfully transmitting electricity for lighting and power purposes over distances ranging from 1 to 30 miles.

It will be proper to outline here the various methods of transmitting power over long distances by electricity, but for full information on this subject recourse must be had to the technical writers in the electrical journals and society transactions.\*

\* See W. F. C. Hasson's paper on "Electric Transmission of Power Long Distances," Transactions of the Technical Society of the Pacific Coast, Vol. X, No. 4; "Long Distance Transmission for Lighting and Power," by Chas. F. Scott, E.E., Vol. IX of Transactions of American Institute of Electrical Engineers; also pamphlet on Long Distance Transmission by L. B. Stillwell, E.E., issued by Westinghouse Electrical and Manufacturing Co., Pittsburg, Pa.

Power may be transmitted by means of electricity by—

1st. The direct or continuous current.

2d. The alternating current --

<p>(a) Single phase, 2-wire synchronous system.</p> <p>(b) Two-phase, 4-wire system.</p> <p>(c) Polyphase system; usually 3-phase with 3 wires.</p>	{	<p>Either synchronous or independent speeds of generator and motor, as desired.</p>
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The direct or continuous current has the advantage that the motors are self-starting, and at practically full torque, or turning effect. The motor speed is quite independent of that of the generator, though this is not necessarily an advantage, inasmuch as, in synchronous systems, the governing of the generator speed regulates that of the motor as well, and therefore attention to the speed of but one machine is all that is required.

Direct-current dynamos labor under the disadvantage of working under comparatively low potentials, since they require a commutator to change the alternating current they generate into a continuous one, *i. e.*, a current flowing constantly in one direction; and thus far it has been found impracticable to insulate this commutator for very high tensions. While it is asserted that\* "direct-current machines of 5,000 volts are in regular and successful use for arc-lighting," it must be borne in mind that the requirements for furnishing light a limited number of hours each day are very different from the demands made upon electrical machines by a stamp mill or hoisting works, which require unintermittent operation, oftentimes including Sundays.

Hence, such a high-potential, direct-current machine, if in good running order to-day, would hardly be serviceable for long-distance transmission, and indeed the staunchest advocates of the direct current in this country have never installed such a machine for this purpose.

On the contrary, in several cases where electrical companies known to favor the direct-current system have had contracts for the installation of long-distance transmission plants, they have not attempted such, but have instead used an alternating-current system in every case where the distance exceeded three miles.

It is safe, therefore, to conclude that until these difficulties of commutator insulation are overcome,† this distance is the practical limit for direct-current transmission, unless a series arrangement of generators and motors be resorted to.

A low potential necessarily limits the distance of transmission, since the size of wire is directly proportional to the number of amperes of current to be carried; and since amperes times volts equals watts, of which 746 are equivalent to 1 horse-power, it follows that to transmit

\* The "Electric Transmission of Power," Engineering Magazine, June, 1894, p. 393.

† Mr. E. H. Booth, in an article entitled "Electricity as applied to Mining Operations," published in "Industry" for June, 1892, says: "It is, however, a matter of difficulty to make commutators for potentials over 2,000 volts for direct-current generators, on account of the great number of segments required, and the difficulty of their proper insulation. While this voltage will be efficient and economical, both as regards cost of installation and of operation in many cases, conditions will also be met with requiring much higher voltages, which are at present commercially practicable only through the use of alternating currents."



100 horse-power, or 74,600 watts, a given distance at a pressure of 500 volts (the ordinary voltage of a direct-current dynamo), would require a current of 149.2 amperes, or a wire six times as large (sectional area six times as great) as that needed to deliver the same amount of power over the same distance at an electrical tension of 3,000 volts ( $25 \text{ amperes} \times 3,000 \text{ volts} = 75,000 \text{ watts} = 100 \text{ horse-power}$ ).

The series arrangement of generators and motors alluded to has been introduced abroad, notably in Switzerland, and brought there to a higher state of perfection than in this country. This application of the direct current for long-distance transmission requires a number of generators and an equal number of motors, making a complicated apparatus of excessive first cost, especially so since extra dynamos and motors must be provided; otherwise an accident to one machine disables the entire plant.

At Genoa, Italy, there is such a transmission at present in operation. The power transmitted is 300 horse-power over a distance of 18 miles. At the power stations, of which there are three, one below the other, there are four groups of dynamos, each group of two dynamos being driven by turbines (Piccard system) of 140 horse-power, working under heads varying from 225 to 495 meters.

These dynamos are connected in series, one group being held in reserve in case of accident to any of the others, and produce each a current of 47 amperes at 1,000 volts electrical tension, the resulting E. M. F. sometimes reaching 6,000 volts during the hours of maximum load. The motors are also connected in series, no one machine, it will be noted, carrying a potential exceeding 1,000 volts at any time. The power is utilized in operating a factory at the terminus of the line.

The lack of flexibility of the system and its inadaptability to a wide and varied range of work have often been spoken of by technical writers, and these disadvantages have prevented its successful competition with alternating-current systems for transmission—such as that from Niagara Falls to Buffalo, where the power is to be utilized for a great variety of work.

It has been cited as an advantage of the direct-current system that it is not liable to trouble from the static capacity and self-induction of the line occurring with the alternating-current. Self-induction will reduce the potential at the motor end of the line, while static capacity will act in the opposite direction and increase the E. M. F., thus tending to counteract the effect of self-induction.

The discussion of these technicalities can safely be left to the electricians, but the writer can state from experience with a transmission by the alternating-current synchronous system of 120 horse-power over a distance of  $12\frac{1}{2}$  miles that no trouble whatever has arisen from these causes. (See table showing the line-loss and the efficiency of this transmission.)

The three types of alternating-current machines, viz., the single-phase synchronous, the double-phase, and the three-phase generators, may, for purposes of comparison, be likened, respectively, to the single-cylinder steam engine, the double or two-cylinder engine with crank arms at  $90^\circ$ , and the three-cylinder engine with as many crank arms set at an angle of  $120^\circ$  each with the other; the electrical impulses bear just these relations with each other in the armature of the dynamo.

The single-phase generators and motors are necessarily synchronous,

and the latter are not self-starting, but must be brought up to the generator speed before the line current can be led into its armature; while the polyphase machines are self-starting under light load, but not under full load.

It is evident that for hoisting and similar work, where full load is thrown on the machine at once, alternating-current motors do not possess the advantages of direct-current machines, which start readily under such conditions, and for short periods can be greatly overloaded without damage.

If, therefore, it be desired to use electric power in all departments of a mining plant, the electricity being generated at a considerable distance from the works, cheapness of first cost and of copper conductors can be obtained by using a high-potential alternating system, with raising and lowering transformers if necessary; while by using rotary transformers, or motor generators, as they are sometimes termed, at the delivery end of the line, direct current can be obtained for all work requiring self-starting motors. These machines used for transforming alternating current into direct current at various potentials have a common field, and two windings upon the armature revolving within it, one of which receives the alternating current and acts as a motor, while the other generates the required direct current.\*

For long-distance transmission the alternating current possesses the great advantage of being convertible from a low to a high potential, or vice versa, by means of a simple transformer, without moving parts, thereby effecting a great saving in copper, since, as already shown, the greater the E. M. F. the less number of amperes of current required to transmit a given power, and hence the smaller wire demanded. Single-phase, alternating-current motors, while not self-starting, may be heavily overloaded without pulling them out of synchronism and causing them to stop; and should the latter occur, no damage will result under ordinary conditions, since the self-induction of the armature will hold back the current for several minutes. They may be also heavily overloaded immediately after synchronizing. The 120 horse-power motor in the mill of the Standard Consolidated Mining Company at Bodie, Cal., has started all twenty stamps while resting upon the cams, though this, of course, is not the ordinary way of taking up the load. It shows that the motors will take an abnormally heavy load at the outset without damage beyond a little extra sparking at the commutator.

The two-phase four-wire system is equally adapted for both lighting and power, and it is not necessarily synchronous, though the advantage of speed regulation previously referred to makes it advisable to so operate the generator and motor wherever possible. It will furnish power through motors of either the rotating-field type (*i. e.*, rotating magnetism) or the polyphase; and by means of commutating devices

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\* Induction motors (three-phase) are now being built by the General Electric Company, and quarter-phase machines by the Westinghouse Electric and Manufacturing Company, which it is claimed are fully equal in every respect to direct-current machines. This is a development only to be expected in view of the fact that the best electricians in the country have been devoting their best energies to the attainment of this most desired result; and it will greatly simplify any quarter-phase or three-phase transmission plant where the power is to be used for the various classes of work required in mining.

it can be made to supply direct current for all power and lighting work if so desired, and at a very high efficiency of transformation.

It is therefore particularly well adapted to mining requirements, which, as stated, demand motors starting immediately and with full torque for certain classes of work.

"There are two especially prominent types of these machines. The first of these, the double machine, has two fields and two armatures, the latter mounted on the same shaft. Each armature delivers alternating current to a two-wire circuit, and these circuits taken together constitute the four-wire circuit of the generator; or they may be so connected as to constitute a three-wire circuit.

"Machines of the second type have single armatures with two windings, or with a single winding so connected to the ring collectors as to deliver two currents differing in their time relation or phase."\*

Twelve machines of the first type and of 1,000 horse-power capacity were used by the Westinghouse Electric and Manufacturing Company as single-phase generators for lighting purposes at the World's Fair. Some of these were used for power to run exhibit motors, and in these cases were connected as quarter-phase (two-phase) machines.

There is a decided advantage in this system over the three-phase in the distribution of load on the two circuits of which it is composed, as the machine can be designed to regulate each current independently, *i. e.*, maintain a constant E. M. F. with varying loads on the circuit, which cannot be done with the three-phase system.

This advantage largely offsets the saving in copper of the latter system, which saving can be put roughly at about 25 per cent over that of either the single two-wire or two-phase four-wire systems. These latter stand on about an equal footing as regards the amount of copper required for transmitting power over a given distance at a stated potential.

"In a paper read before Section 'G' of the British Association, on September 18, 1893, Mr. Gilbert Kapp makes the following statement: 'If we put all the systems on the same footing as regards efficiency and safety of insulation, we find the following, *viz.*: For the transmission of a certain power over a given distance \* \* \* the single-phase alternating and the two-phase four-wire system will require 200 tons, the two-phase three-wire system will require 290 tons, and the three-phase three-wire system only 150 tons. As far as the line is concerned there is thus a distinct advantage in the employment of the three-phase system.'"<sup>†</sup>

For the amounts and cost of copper required for transmitting power over varying distances and under different potentials, the reader is referred to the papers by Messrs. Hasson and Stillwell, already cited.

From the foregoing it would appear that for the ordinary work of stamp mills, where single large units of power are chiefly needed, the single-phase synchronous motors are well adapted to meet all requirements where the power is transmitted from a distance too great for the use of the direct current; while for a more extended and varied use of

\*From "Transmission of Power," a pamphlet issued by Westinghouse E. & M. Co., and prepared by L. B. Stillwell, E.E.

<sup>†</sup>"The Electrical Engineer" (N. Y.), January 17, 1894, p. 42.



such power the polyphase systems are more economical and comprehensive, more especially the two-phase four-wire method.\*

In the paper by Mr. E. H. Booth, already referred to, he speaks of the use of separate motors for each stamp battery, and for groups of four pans and two settlers each, thus doing away with heavy and expensive line-shafting, belt alley-way, etc.

Such an extreme subdivision of the power, however, would result in a heavy loss of efficiency, and is further highly impracticable at present on account of the high speeds at which electric machines operate, necessitating counter shafting to reduce the revolutions to the slow speed of pan and cam shafts.

It is better, therefore, for milling work, to use a single large motor to operate the stamps, pans, etc., with perhaps one or two small ones for rock-crushers and concentrators in cases where the cost of the power or the production of higher-grade concentrates makes this an object.

The following description of the power-transmission plant of the Standard Consolidated Mining Company, at Bodie, Cal., is taken from the writer's paper read before the American Institute of Mining Engineers at the Virginia Beach meeting, February, 1894:

#### THE ELECTRIC POWER TRANSMISSION PLANT OF THE STANDARD CONSOLIDATED MINING COMPANY.

At Bodie, Mono County, Cal., the ruling price for wood has been, for years past, \$10 per cord, so that the monthly fuel bills of a 20-stamp mill, crushing and amalgamating 50 tons of ore per day, would often amount to \$2,000. To reduce this excessive cost of motive power was the problem in hand, and the use of electricity generated by water power has solved it. No sufficient water power could be found nearer than  $12\frac{1}{2}$  miles, the distance from Bodie in a straight line over the hills to the east flank of the Sierra Nevada. This distance is just at that intermediate point where the cost of transformers about equals the difference in cost between a No. 1 and a No. 6 copper wire (it is not advisable to use any lighter wire than No. 6, on account of its liability to rupture during storms). Hence it was deemed better not to use converters, since they would only complicate the apparatus, without effecting a saving in cost.

#### *Water-Power Plant.*

An excellent water power was found in a mountain stream on the north slope of Castle Peak, in the Sierra Nevada, known as Green Creek, and forming one of the chief sources of the East Walker River. This stream carries 400 in. of water during the dry season, and ten times that amount during the time of melting snows.

An old ditch was cleared out and rebuilt for a length of 4,570 ft., and a site was selected for a power-house 355 ft. vertically below its lower

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\* For a full comparison of the relative advantages of the two-phase and the three-phase circuits, see "Polyphase Transmission," by Chas. F. Scott, in the "Electrical Engineer" (N. Y.), March 21, 1894. In this article Mr. Scott proposes a combination of the two-phase and three-phase systems, generating under the first system, and by means of special transformers (while also raising the potential if so desired) changing to the three-phase for the transmitting line and again converting to the two-phase current at the delivery end of the transmission, thereby uniting the advantages of saving in copper, of the one system, with those of greater simplicity, less cost of apparatus, and better regulation of the other method (the two-phase).



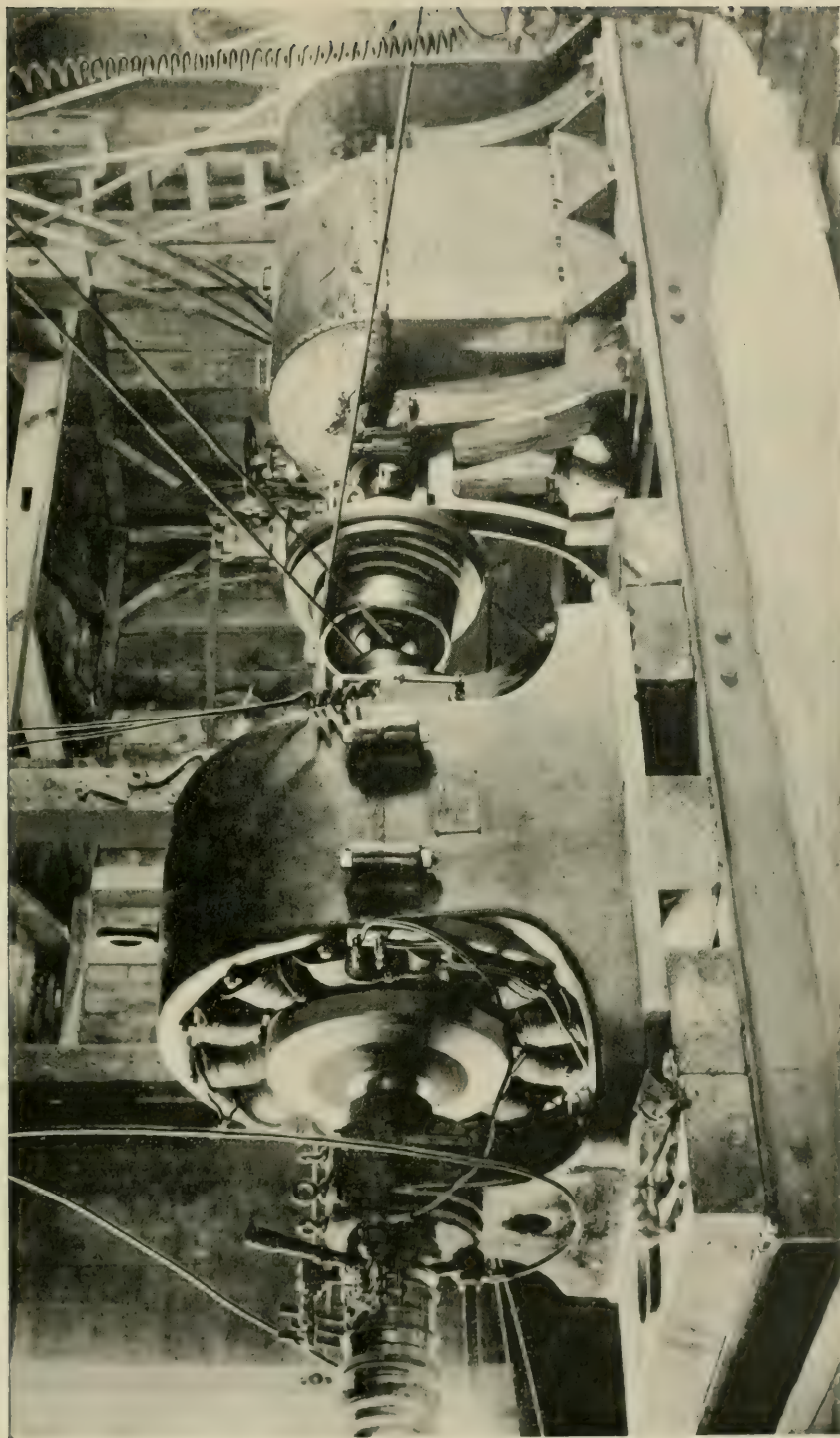
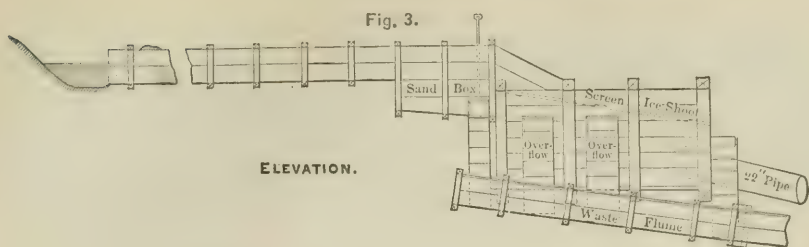


Plate I. Generator and Waterwheels in operation.

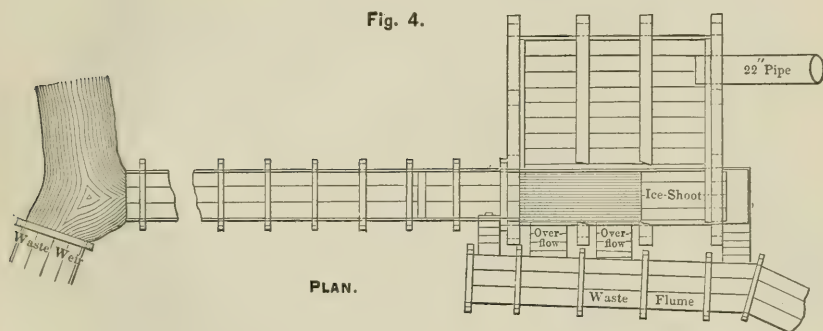






## PENSTOCK AND FLUME.

Scale  $\frac{1}{4}$  in. = 3 ft.  
1893.



end. The ditch was made larger than necessary for power purposes alone, with the object of supplying other parties, when there was an excess of water.

The maps, Figs. 1 and 2, give the data with regard to the ditch and pipe; and Figs. 3 and 4 show the connecting flume, pressure-tank, and waste-weirs. The arrangement of the screen adopted, while it occasions a loss of head of a couple of feet, is greatly to be recommended where "anchor" and slush-ice form in a ditch during cold weather.

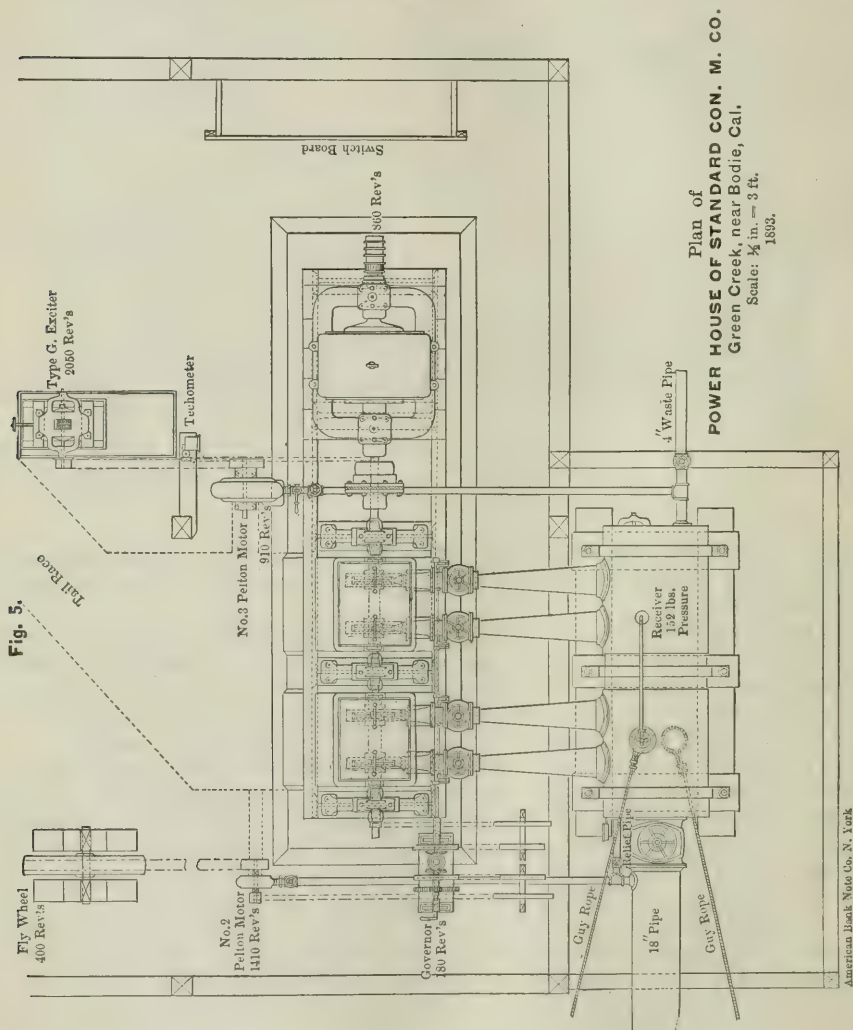
The pipe is of large diameter, in order to permit subsequent enlargement of the plant, and also to reduce loss of head by friction. It is fitted with three  $2\frac{1}{2}$  in. air valves, to prevent collapse in case of sudden rupture, and is anchored at proper intervals with straps of  $1\frac{1}{4}$  in. round iron. The slip-joints extend to a vertical head of 220 ft., the remainder of the pipe being laid with collar-and-sleeve lead joints.

The pipe leads into a receiver 40 in. in diameter and  $9\frac{1}{2}$  ft. long, from which four taper-pipes lead the water, under pressure of 152 lbs. per square inch, to as many 21 in. Pelton waterwheels, each wheel being fitted with two nozzles and rated at 60 horse-power under the largest sized tips of  $1\frac{1}{8}$  in. diameter.

The speed of the wheels is 860 to 870 revolutions, and their shaft is connected by an insulated rigid coupling to the armature shaft of a 120 K.-W. A. C. generator. Plate I shows the generator and waterwheels in operation.

*Power-House.*

The accompanying plan (Fig. 5) shows the arrangement of the plant, one of the most interesting features of which is the water-governor formerly known as the "Doolittle," and now called the Pelton differential governor (Figs. 6 and 7). It operates butterfly-valves placed in the 5 in. pipes between the gate-valves and the diverging nozzles; and though this form of valve invariably "throttles" the water to a greater or less



extent (according to the position of the valve), it is a most satisfactory way of controlling the power where the same is ample, and the loss due to this cause is of slight consequence. The governor operates as follows: Two 18 in. pulleys revolve loosely and in opposite directions on a shaft, one being driven from the waterwheel shaft and the other by a No. 2



Pelton motor. These pulleys have gears on their hubs which mesh into two other gear-wheels carried on an axis at right angles to the shaft and keyed fast to the latter. Beyond these wheels is a pinion, loose on the shaft and with ratchet-teeth cut in opposite directions on either side of its hub. Into these ratchet-teeth mesh corresponding circular ratchets, which are keyed to the shaft but free to move longitudinally along the same, and are thrown in or out of gear by a short lever and spring. The pinion engages a sector, which is fastened to the rod and levers that operate the butterfly-valves, and on the same rod is a hand-lever, by means of which the valves may also be opened or closed by simply throw-

Fig. 6.

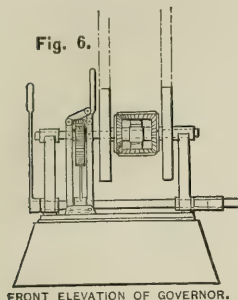
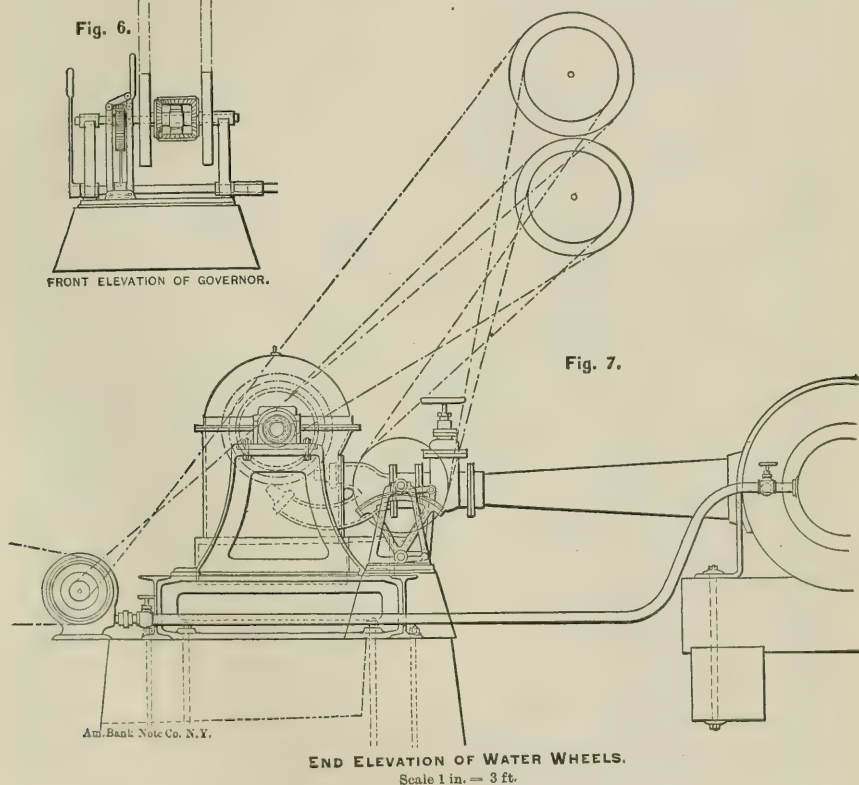


Fig. 7.



ing out of mesh the circular ratchets alluded to and thereby detaching the governor. It is evident that when the two pulleys are revolving in opposite directions at exactly the same rate of speed, there will be no motion of the central gear-shaft, and none will be communicated to the pinion and sector and thence to the valves, to open or close them; while, on the other hand, a difference in speed of these pulleys will have the opposite effect. The belts driving them are therefore so arranged that a decrease in speed of the waterwheels will open the valves, and an increase will close them.

In starting up from rest, the governor is detached by throwing out the springs on the ratchets, and the valves are operated by the hand-lever.

After the wheels are at normal speed and the load is on, the ratchets are sprung into gear with the pinion, and the governor takes care of any and all variations, even to a complete throwing off of the load by pulling the main-current plug-switch at Bodie. The speed of the governor-pulleys, as first designed, was 60 revolutions. This was found to be too slow, and it was increased to 180 revolutions with most beneficial effects, developing a greater sensitiveness to small changes of load, and much quicker action, especially when all the load was thrown off at once. In the latter case, the increase in speed of the waterwheels did not at any time exceed 12 per cent before the governor began to close the valves.

It was further found necessary to furnish a constant resistance for the water motor that drives one side of the governor, to work against. In the original plan this was to be done by the exciter which furnishes current for the fields of the generator; but on trial it appeared that the load on the exciter was too variable, and at times too great for the little motor to take care of. The exciter was then placed so that it could be driven by either a larger size (No. 3) motor or by the waterwheel shaft-coupling (see plan of power-house); and a fly-wheel of about 1,500 lbs. weight was set to be driven by the smaller motor and insure its constant speed.

The great drawback to the use of water power for the generation of electricity has hitherto been the lack of a good water-governor, sufficiently sensitive and quick-acting to insure the vital factor of constant speed without bringing dangerous strain on the water pipe. In fact, in the Westinghouse plant at Telluride, and in several others of which the writer is aware, the "one-man automatic regulator" had to be used; *i. e.*, a man sat with his hand on the lever of a deflecting nozzle and his eye fixed on a voltmeter or a tachometer. The above-described governor is so great an improvement over this system that its operation has been given in detail.

The generator is a Westinghouse 120 K.-W. constant-potential twelve-pole machine, and its armature-shaft is attached to that of the waterwheels by a rigid coupling, insulated by a disk of hard rubber one inch thick, and projecting one inch beyond the flanges, while the bolts are surrounded by bushings and washers of insulating-fiber.

The initial current in the lower half of each field-coil, or the winding nearest the armature, is instilled by means of a type "G" D. C. exciter. The secondary winding, on the armature-spokes of the dynamo, generates current when the machine is under load, which is led to a twelve-bar commutator on the armature-shaft and thence to the compensating-winding which occupies the upper half of each field-bobbin.

As the load on the generator increases, more current flows through its armature-coils, and through a primary winding on the armature-spokes, thereby inducing, in the secondary winding, a heavier current, which, being led to the magnetic field as described, proportionately strengthens the same. When the generator is running without load, there being little or no current in its armature-coils, none is induced in the secondary winding, and the compensating-winding on the fields is without magnetic effect until the latter is required by work to be performed.

The potential of the generator under full load is 3,530 volts, but at present it is operating with about 3,390. The exciter carries a voltage of 105 to 112. A "D. C." voltmeter, recently placed on the switch-board to the left of the ground-detector and above the small rheostat, is in the

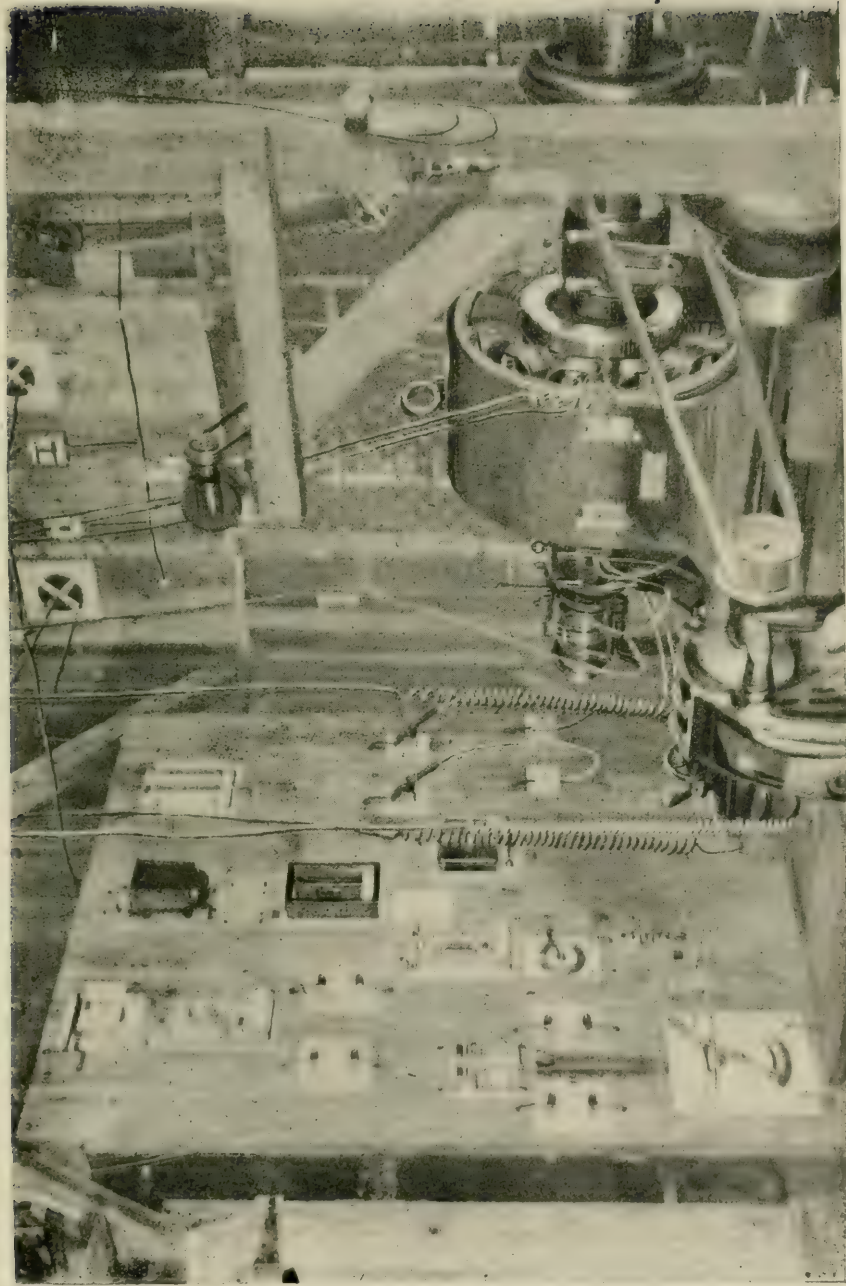


Plate II. Generator Switch-Board at Power-House. (Generator in operation; Exciter in foreground; Choke-Coils and Gap-Lighting-Arresters on separate board.)





main circuit of the exciter, recording the tension of its current and serving as a speed indicator when the machine is driven by the No. 3 motor. This is not necessary when driving from the wheel-shaft, as is sometimes done in winter, when pieces of ice give trouble in the small nozzle of the motor.

Plate II shows the generator switch-board at the power-house. The generator current is led from the collector-rings on the extreme end of the armature-shaft to the plug-sockets on the switch-board; and when the line-plugs are in these, the current follows the line to two similar sockets on the motor switch-board. The small converter in the upper middle of the switch-board has a transforming ratio of 30 to 1. Its primary coil is attached to the main-current wires from the generator, and its secondary to the A. C. voltmeter, immediately below it. A potential of 113 volts on the voltmeter is therefore equivalent to 3,390 on the dynamo current, which is the tension under normal load. The voltmeter does not, however, read 113 volts, but records 100 to 102 volts, the difference being due to the compensator (the instrument shown in the upper left-hand corner of the switch-board and connected with the voltmeter), the object being to reduce the reading by an amount about equal to the line-loss. This loss is estimated at 15 per cent under maximum load, and is but from 8 to 10 per cent under normal load, as will be shown later on.

The ammeter, and just below it the aluminum fuses, all of which are in the main circuit, are shown to the left of the voltmeter in the view of the generator switch-board.

Immediately to the left of the main-line plug-switches is the ground-detector with two lamps, one for each leg of the line, and each lamp with its converter behind it.

A press-button below the lamps makes the necessary connection with a ground wire. Without this connection made, the lamps show a red light on the filaments, due to the difference in potential of the two sides of the line; and should a "ground" occur on either leg of the wire-line, the corresponding lamp immediately burns at full candle power, while the other lamp proportionately diminishes.

The two-pole jaw-switch to the left of the switch-board is in the circuit from the exciter to the generator-fields, as are also the two fuses and the rheostat immediately below it. The small rheostat to the right of the fuse-blocks and the single-pole switch below it are in the shunt field-circuit of the exciter. By means of these two rheostats the potential of the generator is governed and the voltmeter kept at its proper reading, the large rheostat in the exciter and generator field-circuit permitting a quick regulation over a wide range, and the shunt-rheostat a finer and closer adjustment of the voltage.

When starting up the plant one attendant stands at the lever, controlling the admission of water to the wheels through the butterfly-valves, and the other at the switch-board, handling these two rheostats (most of the regulation is done by the large one), until the motor is in synchronism and at work, when the governor is thrown into gear, the voltage is finally adjusted, and the mechanism is then practically self-regulating for all ordinary changes of load. If, for instance, ten of the twenty stamps are to be hung up, or any or all of the eight continuous-pans in the mill are to be stopped, it is never necessary first to give word to the attendant at the power-house. The governor takes charge of such

changes, even to the entire throwing off of the load, as before remarked. All the bearings of the generator and waterwheel shafts and of the exciter are self-oiling. The attendant has merely to keep on the *qui vive* and see that all is running smoothly. Any change in tone of the hum of the dynamo warns him at once of a change of conditions, the tone rising or falling according as the speed increases or diminishes, though ever so slightly.

To insure the all-important factor of constant speed, a tachometer, registering to 1,200 revolutions, is belted to the waterwheel and dynamo shaft. Its dial faces the waterwheels, so that the attendant at the valve lever can readily maintain a uniform speed during the operation of "synchronizing" the motor and starting the mill, at which time the load is constantly varying.

In front of the jaw-switch on the switch-board there will be noticed, in the view of the latter, a steel spring, and also two cords attached to the handle of the large rheostat. These cords are led around the side of the building to the attendant's place at the valve-lever, as is also the one that releases the catch of the spring. A pull on these cords opens the exciter main-circuit instantly, and puts in the entire resistance-box, thereby "killing" the fields of the generator and preventing any dangerous rise in electro-motive force, should the load be suddenly thrown off by a break in the wire-line, or other accident causing a sudden increase in the speed of the armature shaft. It should be explained that this arrangement was devised by the writer, before the speed of the governor was trebled, the constant-resistance fly-wheel was put in and other changes were made, giving more sensitive and perfect control of the water power; and it is left in place because it might still be of use in case of emergency. The power-house is lit by a small 10-light converter attached to the generator-circuit, and when the generator is not in operation, by current from the exciter. Plate III shows the power-house at Green Creek.

#### *Wire-Line.*

The length of the line is 67,760 ft., or 12.46 miles. The poles are of round tamarack timber, 21 ft. long, 6 in. in diameter at the top, set 4 ft. in the ground; poles 25 ft. long being used through the town, and along the line wherever there is danger of deep snowdrifts. They are placed 100 ft. apart, and fitted each with a 4 by 6 in. cross-arm, boxed into the pole, and held by one bolt and one lag-screw. The accompanying sketch (Fig. 8) shows the detail. The object of chamfering the ends of the cross-arms is to leave less room for the lodging of snow under the insulator.

The line crosses extremely rough country, not 500 yds. of which is level beyond the town limits. Most of the ground is very rocky, over 500 lbs. of dynamite being used in blasting the pole-holes. Plates IV and V are views along the line in summer.

The wire is of No. 1 (B. & S.) gauge, soft-drawn bare copper, and is attached to standard, double-petticoat, deep-groove glass insulators (Fig. 10) carried on Klein patent iron pins (Fig. 9). The distance between the wires is 3 ft. 8 in., and there are over 16.5 tons of copper in the line. The only objection found to the iron pins is their liability to be withdrawn from the cross-arm during a gale of wind, whenever there is an upward pull on the wire. To obviate this a number of pins were drilled





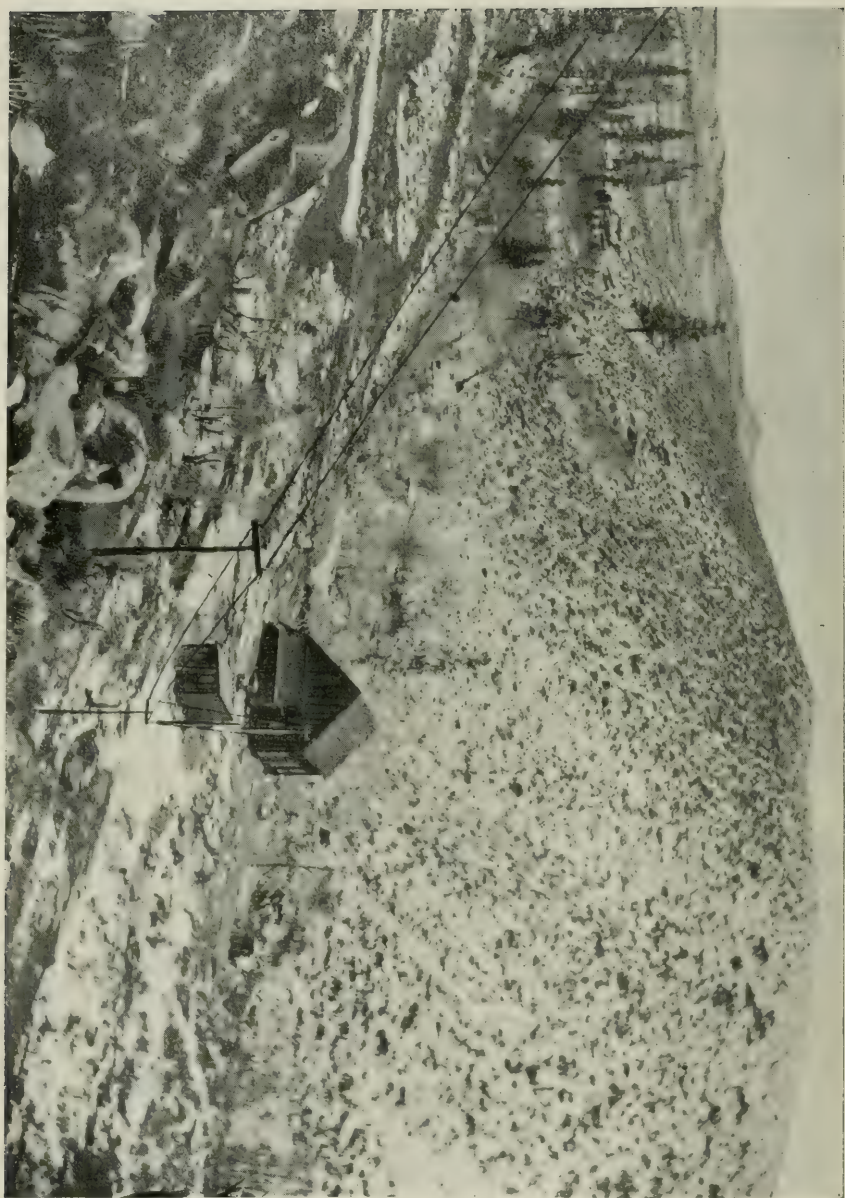


Plate III. Power-House at Green Creek.



Plate IV. Summer View on Pole-Line, looking east, 10 miles from Fodle.

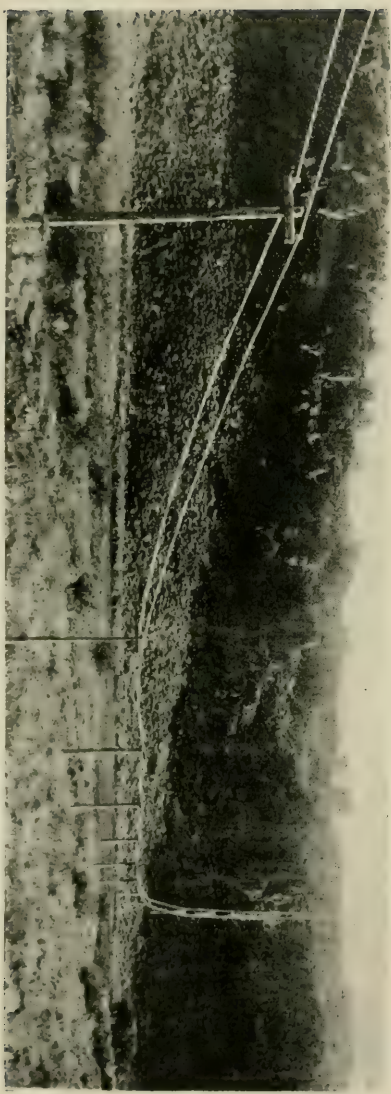
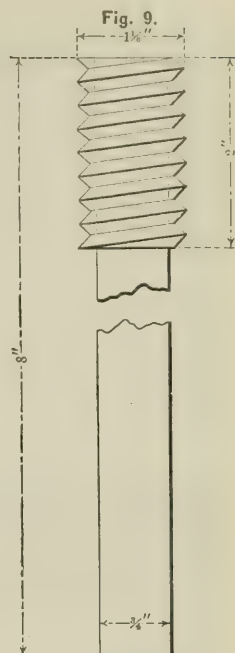
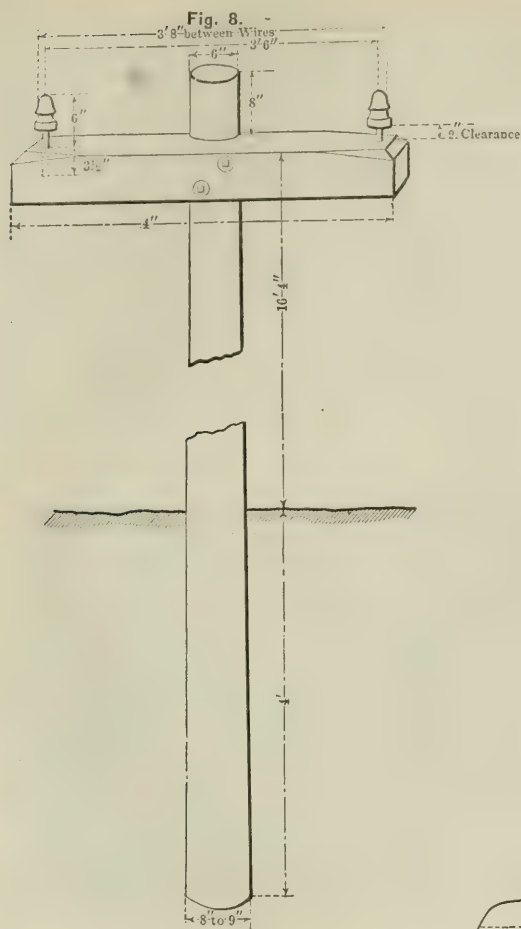


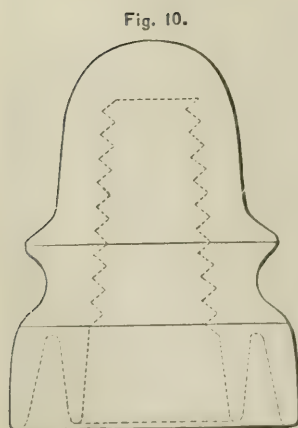
Plate V. Summer View on Pole-Line, looking west, 10 miles from Fodle.



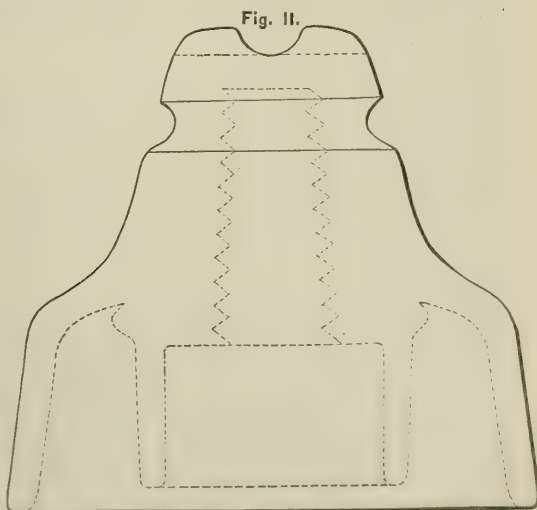




KLEIN PATENT IRON PIN.  
LEAD THREAD.



DEEP GROOVE DOUBLE-PETTICOAT  
GLASS INSULATOR. HALF SIZE.



WESTINGHOUSE "POMONA" DOUBLE-PETTICOAT  
GLASS INSULATOR. HALF SIZE.

LINE DETAILS.

with an  $\frac{1}{8}$  in. hole near the end, and in all such places these were used, and held firm by driving a wire nail through them.

The wire was first attached to the insulators by tie-wires of No. 10 galvanized iron wire. Later it was found advisable to insulate the line-wire at the insulators, and for this purpose ordinary sheet-rubber  $\frac{1}{8}$  in. thick, such as is used for gaskets, was cut into strips 1.5 in. wide and 12 in. long. These were wound spirally about the wire and held in place by two close wrappings of Manson's tape. The whole was then well daubed with asphalt paint, and the insulated wire re-attached to the insulators by tie-wires of No. 6 weather-proof copper wire.

The line crosses a number of very steep ridges (from 300 to 800 ft. in height), and on these the wire necessarily pulls heavily on the top pole, and especially on its pins and insulators. In all such places the ordinary double-petticoat insulators were replaced by the large "Pomona" insulator (Fig. 11), on which the wire is carried in a groove across the top, and its weight is therefore directly down upon and in line with the center of the pin.

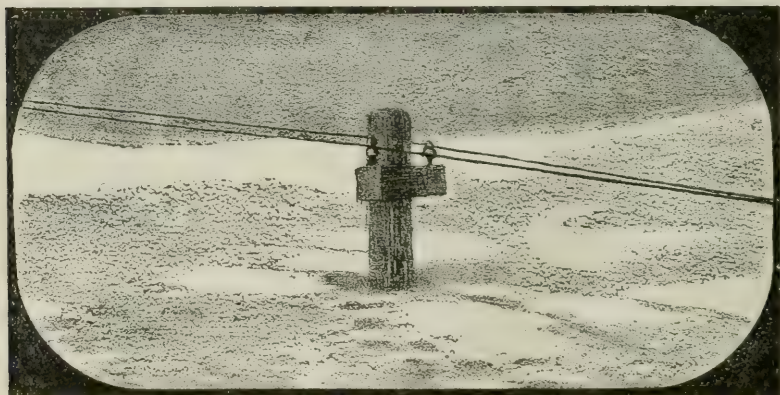


FIG. 12.

Pole No. 40; 4,000 ft. from Mill.

(Wire is 17 ft. above ground at pole. Snow-drift 15 ft. deep, March, 1893.)

The line has given no trouble whatsoever, and has carried the high potential of 3,000 volts without a leak, even during a severe storm of ten hours' duration, the rain changing to sleet and ice toward the end; but this severe test, it must be admitted, occurred after the wire had been wrapped at the insulators as described. In fact, one of the chief objects of this insulation was to render the line proof against just such a storm as this. Snow-storms have no effect whatever. (See Fig. 12.)

#### *Motor-Room.*

The motor that drives the stamp mill of the Standard Consolidated Mining Company at Bodie is an A. C. synchronous constant-potential machine of 120 horse-power. The mill contains twenty 750 lb. stamps, four wide-belt (6 ft.) Frue vanners, eight continuous-process amalgamating-pans (two of which are constantly grinding), three settlers, one



Plate VI. Motor in operation. Standard Con's Mill.

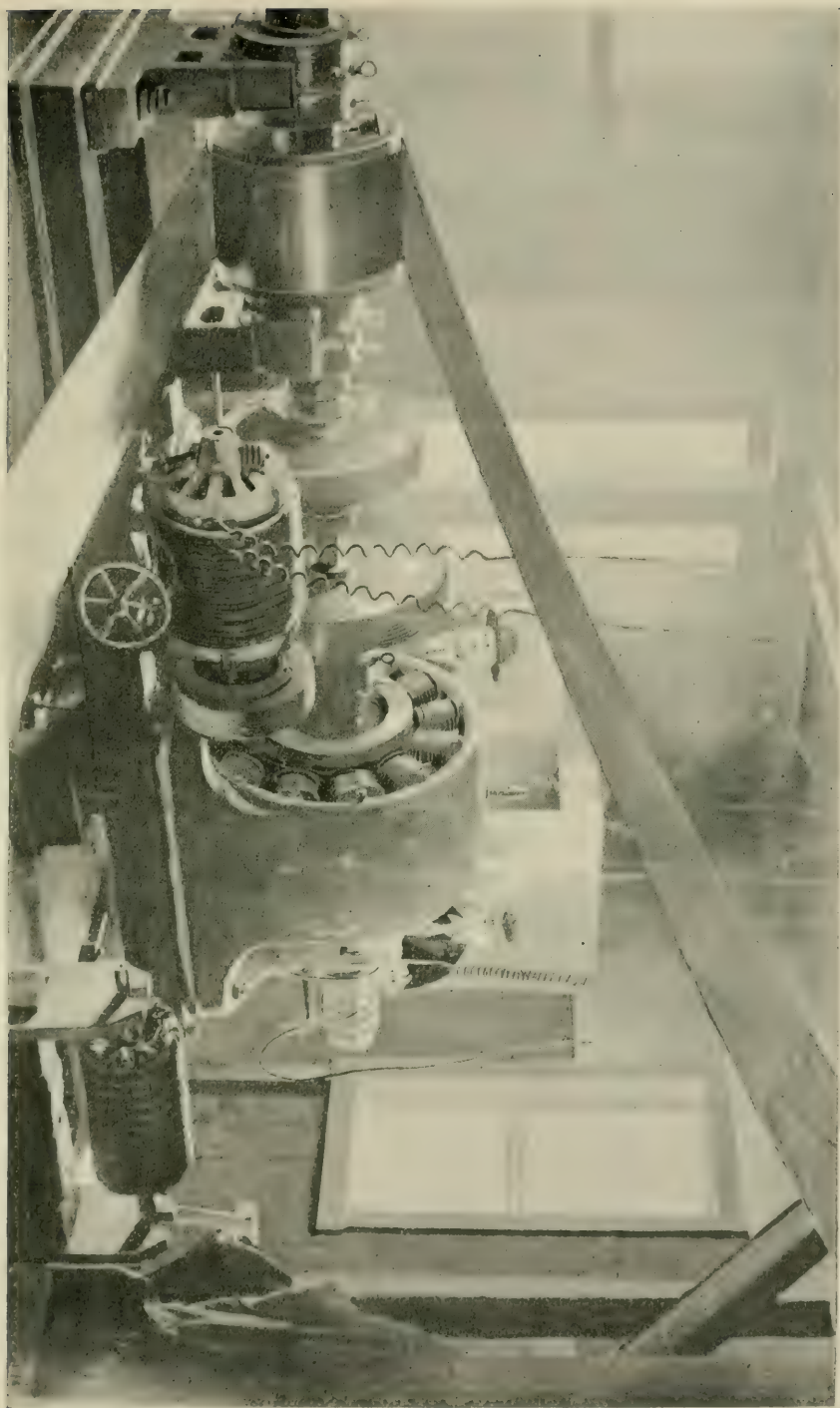






Plate VII. Motor Switch-Board.





agitator, one pan and settler devoted to the amalgamation of concentrates, a bucket elevator, a worm-gear hoist, and a rock-crusher. In order to determine accurately the capacity of motor required, a number of cards were taken with the Tabor indicator from the 20 by 36 inch steam engine that drove the mill, showing an average of 90 and a maximum of  $101\frac{1}{2}$  horse-power.

The fields of the motor are self-exciting through a secondary winding on the teeth of the armature, the current being led to a twelve-bar commutator similar to that on the generator. In fact, the motor is almost identical with the generator, the chief difference being in the compensating-winding on the field-bobbins of the latter.

On the armature-shaft of the motor is a friction-wheel, and beyond this a clutch, which is used to set in motion the driving-pulley and the machinery of the mill. On the same bed-plate with the motor is a small 10 horse-power Tesla starting-motor, with a wooden pulley on its shaft, that is brought to bear against the friction-wheel mentioned, by means of a screw and hand-wheel. This Tesla motor consists simply of field-coils and an armature; it has neither brushes, nor commutator, nor sliding contacts of any kind. The alternating current is led directly into the fields, the stationary element, the coils of which, being connected in series, produce a rotating magnetic field, in that each pole is alternately positive and negative. The starting-torque of the armature is, in consequence, very low, and it has to receive several rapid turns by hand before putting on the current, after which it generally runs up to normal speed (1,660 revolutions) within a minute. Plate VI shows the motor in operation.

Turning our attention to the switch-board, shown in Plate VII, the two plugs in the sockets on the right of the board are the line-plugs, and the two to the left of them, in their rests, are the starting-motor plugs. When the line-plugs are in their sockets the current is led directly to the top of the upper jaw-switch, and this switch is never closed until the machines are in synchronism. The wires from the bottom of this switch lead directly to the collector-rings on the armature-shaft of the motor.

In the upper right-hand of the board is the Wurts lightning-arrester, consisting of 22 spools, 11 on a side, separated each by a distance of  $\frac{1}{32}$  in. Both legs of the wire-line are attached to the arrester, one on each side at the top, while the ground-wire leads from the bottom spools to a water-pipe in the earth. The spools are made of a patent non-arcing metal, and the dynamo current will therefore not follow the path through them made by a discharge of high-tension atmospheric electricity. The properties of this alloy are such that oxides of the metals are generated by the passage of lightning and not vapor of the metal itself.

To the left of this instrument are two converters of the ratio of 30 to 1, filled with paraffine oil. The primary coil of the right-hand one is connected to the main line just above the plug-sockets, and that of the left-hand converter is connected to the motor-circuit, *i. e.*, the wires leading from the collector-rings on the armature-shaft to the bottom of the upper jaw-switch; it being understood that the motor acts as a generator when being driven by the starting-motor.

The secondary of the line-current converter goes to the top posts, marked G, of the synchronizer (the marble plate with four lamps on it to the extreme left of the board), one leg being first carried through the

right-hand side of the lower jaw-switch. When the line-plugs are in, therefore, and this switch is closed, the top light of the synchronizer will always be burning while the generator at the power-house is in operation.

The secondary of the motor-current converter is carried directly to the bottom posts, marked M, of the synchronizer, the two middle lamps of which are connected in series with the motor and generator currents.

The field-circuit of the motor is carried to the switch-board, and in it are placed the large rheostat, the left-hand ammeter, and the left-hand side of the lower jaw-switch. The closing of this switch and an adjustment of the rheostat will therefore cause the lower light on the synchronizer to burn whenever the motor is being run as a generator, as is the case when it is being driven by the starting-motor. The aluminum fuses showing below the converters are in the main line before it reaches the jaw-switch, as is also the ammeter just below them, which instrument should, and does, record the same volume of current as its fellow in the power-house.

To start the motor requires two men, one to handle the starting-motor and the other at the switch-board. The line-plugs are put in, which leads the main current to the top of the synchronizing-switch, and the lower jaw-switch is thrown in, which closes the field-circuit of the motor, and the secondary of the main-line or generator converter, thereby lighting the upper lamp of the synchronizer. The armature of the starting-motor is turned a few times by hand, and the two left-hand plugs are then pushed into their sockets, leading the current from the main line to the fields of this motor.

Immediately upon doing this, the main-current ammeter records 30 amperes, and the needle stays at this reading until the starting-motor is up to speed, when it drops quickly to 18 to 20 amperes. It takes from fifty to seventy seconds for the starting-motor to reach full speed, after which its friction-wheel is brought to bear against that of the main motor, and the armature of the latter begins to revolve. During this time the synchronizing-switch (the upper jaw-switch) is open, and all the resistance-coils of the rheostat are left in the field-circuit, in order that the armature may more easily be brought up to speed, by preventing the flow of current in the same.

As soon as the armature is above speed, about two thirds of the rheostat is thrown out, permitting 40 or 50 amperes of current to flow, and the lower lamp of the synchronizer to burn. The pushing onto its button of the little switch on the bottom of the synchronizer now connects the two central lamps in series with the motor- and the generator-currents, and they begin to flash in accordance with the phases, and therefore the speeds, of the two machines. As the speed of the motor approaches that of the generator, the wave-phases come nearer coincidence, and these lamps brighten and darken almost simultaneously.

The attendant stands with one hand on the rheostat and the other on the open jaw-switch, watching these waves of light intently, and just as the two lamps darken in unison, he throws in the switch and pulls one of the starting-motor plugs. The lamps only remain "out" for a second or less, while the speeds are together, and then flash up brightly again as the motor speed drops off; there is therefore but a fraction of a second during which the jaw-switch should be closed, though this time can be lengthened slightly by a proper handling of the starting-motor.



If this switch has been thrown in at the right moment, the series lights remain "out," while the top and bottom, or "pilot" lights, burn brightly, and so continue all the while the machines are in operation.

If the switch is thrown in a second or so too soon, the main-current ammeter will fly up to 40 or 45 amperes, and quickly drop down to less than 10 as the motor speed decreases, and it falls into step with the generator, while the series-lamps will remain dark, and the pilot-lamps burn as usual. On the other hand, if it is closed several seconds too soon, or a fraction of a second too late, it is impossible for the machines to get into synchronism. In such event all the lights on the synchronizer go out at once, and a heavy flow of current sets in, the main ammeter showing 45 amperes, which is as high as it can record. By the extinction of the lights the attendant sees at once that he has missed the synchronizing-point, and immediately pulls the main-line plug, opens the jaw-switch, and starts over again. The second trial, however, will not consume as much time as the first, since the starting-motor is still revolving at a high speed, and more quickly comes up to its normal rate, while the motor-armature is also running yet at several hundred revolutions per minute.

This very rarely happens, especially since the addition in March last of an acoustic synchronizer to the phase-lamp device. This instrument emits a sound, the pulsations of which are very rapid at first, the interval between them growing longer as the machines approach equal speed, and settling into a steady hum at the moment of synchronism.

It will be noticed that in order to break the circuit and stop the motor it is necessary to pull the line-plug, on doing which a brilliant arc, sometimes 2 ft. in length, if 25 amperes are flowing, follows out from the socket to the plug-tip. Any attempt to open the jaw-switch while the line-plugs are in would doubtless result in the death of whomsoever tried it, since the distance is too short in which to break the arc, and the current would likely follow down the arm in spite of one's standing on an insulated floor. These floors are used around both generator and motor, and in front of both switch-boards.

The entire operation of starting up the motor from a state of rest occupies from three to five minutes, and when once in synchronism, the clutch can be thrown in and the mill shafting brought to normal speed in from one to two minutes more, after which the load may be thrown on as fast as desired without the least danger of pulling the motor out of synchronism. The clutch is always thrown in slowly in order to prevent too heavy a flow of current, and consequent sparking of the commutator brushes.

By means of a single counter-shaft, fitted with self-oiling boxes, the high speed of the motor (860 revolutions) is reduced to the necessary 80 revolutions of the battery line-shaft, the reductions being 2 ft. to 8 ft., and 3 ft. to 8 ft. Light steel-rim balanced pulleys are used, and an endless 16 in. double leather belt runs from the motor to the first 8 ft. pulley. The speed of this belt is 5,400 ft. per minute, and it is kept tight by levers which, acting through screws, move the entire motor and its bed-plate along four grooved, cast-iron slides.

The motor is separated from the underlying brick foundation by means of 8 by 10 in. timbers, which are bolted to the latter and covered by three layers of 1 in. boards; and to this wood insulation the slides referred to are fastened by lag-screws that pass through the boards into

the timbers. The generator is insulated from the I-beams that carry both it and the waterwheels, by timbers  $5\frac{1}{2}$  in. thick, to which it is likewise secured by lag-screws.

The mill and offices of the company are lit by 100-volt incandescent lamps, taking current from a large 100-light converter, ratio 30 to 1, which is attached to the main line in the motor-room, before it reaches the switch-board. The light is very satisfactory, even to read or write by, although at times the lamps flicker slightly, due to small changes of load. This variation of intensity is, of course, unavoidable where the lighting current is taken direct from a power circuit; but, in the present case at least, is not sufficiently noticeable to cause inconvenience.

During normal operation of the plant, the field-ammeter of the motor is, by means of the rheostat, kept steadily at 52 amperes, while with full load on the mill the main-current ammeter registers from 23 to 25 amperes. The needle oscillates over a range of 4 to 6 amperes, showing considerable variation of load, due undoubtedly to slipping of the belts, unequal resistance of the grinding-pans, rock-crusher, etc., so that it is difficult to read this ammeter closely, either at the generator or at the motor.

The average amperes of current can be very closely approximated, however, as was done in the tabulated readings given below, which were taken with the object of determining the line-loss, and with the aid of Mr. H. M. Reed, the engineer of the Westinghouse Electric and Manufacturing Company, who installed and first operated this apparatus.

The readings were taken simultaneously at power-house and motor-room, by means of the telephone, and the figures given are the averages of five or six consecutive observations. There being no voltmeter on the motor switch-board, a Weston portable voltmeter was used, the wires being attached to the lower posts on the synchronizer.

The table is merely a rough approximation of the efficiency of the transmission, there being no instruments at hand for close work, such as the measurement of the wheel-shaft energy, or of that given out at the motor-pulley. The efficiency of these machines, namely, of the generator, 95.5 per cent, and of the motor, 93.9 per cent, was determined by Mr. Fred. A. Davis, electrical engineer of the Westinghouse Electric and Manufacturing Company, in charge of the plant. It will be noticed from the table that the line-loss is very light, and also that as the dynamo and motor approach their rated capacity, the efficiency of the transmission increases.

*Approximate Efficiency of the Transmission at the Standard Consolidated Mine, Bodie, California.*

Date.	Generator.			Motor.			Horse-Power Given Out by Water-Wheels, allowing 95½ per cent Efficiency for Generator, and adding 5 Horse-Power for Exciter.....	Mechanical Horse-Power Given Out by Generator.....	Line-Loss—Per cent .....	Mechanical Horse-Power Delivered to Motor.....	Approximate Per Cent of Full Mill-Load Driven at Time of Test .....	Approximate Per Cent of Water-Power Obtained at Motor-Pulley.....
	Amperes .....											
	Volts.		Equivalent to Volts...	Volts.		Equivalent to Volts ..						
	Voltmeter Reading ..			Voltmeter Reading ..								
December 22d .....	100	3,390	20	103	3,090	20	100.2	90.9	8.9	82.8	82	77.2
December 29th .....	100	3,390	21	103½	3,100	21	105.0	95.4	8.6	87.3	85	78.2
January 16th .....	100	3,390	23	104	3,120	23	114.4	104.5	8.0	96.2	95	79.0
February 1st .....	101	3,420	25	105	3,150	25	125.0	114.6	8.0	105.5	105	79.2

NOTE.—During the above test the exciter was being driven from the wheel-shaft instead of by its separate water motor; hence, the allowance of 5 horse-power.



The proper setting of the brushes on the commutator of the motor-armature is a knack acquired only by experience; and for awhile considerable trouble was caused by undue sparking at these brushes. Experience on the part of the attendants has entirely overcome this; but it has been found necessary to use two commutators, keeping one always turned and polished ready for use, and changing them usually after twenty-five to thirty days of steady operation.

In order to stop the motor, the load is thrown off by means of the clutch, and the line-plug is then pulled. Should the plug be pulled without first throwing off the load, a momentary rise in electro-motive force may follow, sufficient to damage an armature-coil. This has happened once in our experience, and the very high potential was vividly shown by the discharge through the lightning-arresters at both ends of the line.

The dependence of the motor speed upon the alternations of the generator is very prettily shown, when, without pulling the line-plugs, the machines are stopped by shutting off the water on the wheels. The motor then slows down in exact accordance with the generator, and is at rest within half a minute or so; whereas, when the plug is pulled in the usual way, the motor-armature will revolve for several minutes from its own momentum before coming to a stop.

This plant has accomplished several unbroken runs, day and night, one of thirteen days' and another of twenty days' duration, but latterly it has been operated more intermittently, on account of the mill being run upon only half-time. During December, 1893, the plant was started twenty-three times in twenty-one days, and in January eleven times in as many days (in accordance with the requirements of the milling work), these daily startings being an excellent test on both the starting-motor and machines, as at such times the differences in potential, and consequently the strain on the insulation, are likely to be a maximum.

The only trouble now experienced with the plant comes from an extraneous source, common, in a greater or less degree, to all electrical plants throughout the world, namely, occasional incursions of lightning during thunder-storms; or from another, more local cause, already alluded to, namely, discharges of static electricity, due to a gradual charging of the line from a highly charged atmosphere during wind-storms. These have several times caused the burning-out of armature-coils; but this matter is not as serious as it may seem, since but a couple of hours are required to repair such damage. To put in a new coil, the top-half of the field of the machine, weighing about two tons, is swung off by means of differential blocks and an overhead trolley; the burnt coil is cut out with a hack-saw; the new coil is slipped over the tooth and squeezed into place by means of specially-made geared clamps; the connections are soldered, taped, and painted; and the top-field is then replaced in position.

The entire cost of this plant does not exceed \$38,000, while its operation during the month of October alone effected a saving of \$2,100, equivalent to \$1 46 per ton of ore crushed, and reducing the total milling cost to \$2 32 per ton; a fairly low figure for a high-priced camp (wages \$4 per day) such as Bodie.

At present the plant is operating most smoothly, and is successfully demonstrating the effectiveness and simplicity of the single-phase syn-

chronous system for such work and distances, while the daily saving over the use of steam, on twelve-hour runs, is from \$35 to \$40.

The writer takes pleasure in acknowledging the aid of his assistant, Mr. R. C. Turner, E.M., in the preparation of the accompanying drawings.

#### EXTENSION OF THE SYSTEM.

The availability of electric power; the readiness with which, after it is once introduced, it can be applied to any extensions of surface plant or new works such as continually arise in progressive mining, has been recently demonstrated in our experience at Bodie.

For the rapid handling of the tailings, which were to be treated in large vats by a leaching process, it became necessary to put up an incline track about 1,400 ft. away from the mill. To haul the cars up this grade by electric power all that was required was to put in a 15 horse-power direct-current generator at the mill, belt it to the motor, and take current at 500 volts to a 10 horse-power motor at the top of the incline. This is being done, the balance of 5 horse-power to be used in lighting the leaching-plant and operating the necessary pumps.

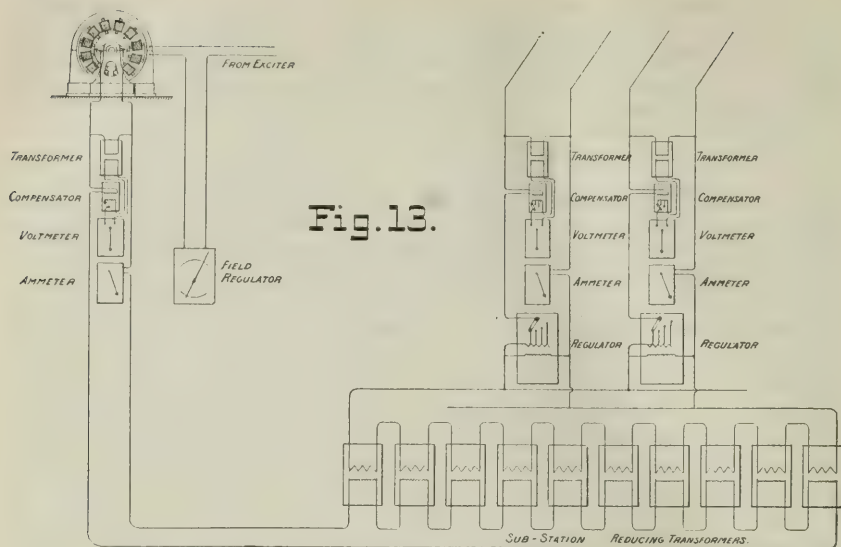
With electricity this transmission of power to the new plant was extremely simple. By rope or other means it would have been expensive, costly to maintain, and much less efficient.

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The following description of the transmission plants of the San Miguel Consolidated Gold Mining Company, of Telluride, Colo., and of the Willamette Falls Electric Company of Portland, Oregon, is taken from "Long-Distance Transmission for Lighting and Power," by Charles F. Scott, being a paper read at the general meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 7, 1892:

"The test of practical operation in long-distance transmission has been applied in but few cases, and the severe test of continued operation over a considerable length of time is of rare occurrence. The latter is the crucial test, and its commercial significance gives it the highest importance. The continued and successful operation of one plant for a year, under extreme conditions of situation and service, is of higher value in testimony to the practical development and possibilities of electrical work than many elaborate projects, or the operation of novel apparatus for a short time.

"It is with this idea in mind that a description is here to be given of two plants, one for lighting and the other for transmission of power. The conditions which have been met include a very considerable distance, extreme difficulties of climate and roughness of country, exacting requirements in continuity of service, and a pressure above that ordinarily used in the class of machines employed. The plants to be described are the first of their type installed in this country, and the apparatus in the power-plant is of a kind that has not been heretofore used. The type and construction of the machines, and the arrangement of apparatus, are new in many particulars, and as they have contributed largely to successful operation they will be described with some minuteness. Alternating-current machinery is employed, constructed by the West-



Lighting-Plant at Portland. Diagram of Apparatus and Connections.

inghouse Electric and Manufacturing Company, the pioneer company in alternating work in this country.

"The lighting-plant was first installed. It is operated by the Willamette Falls Electric Company, of Portland, Oregon. The general requirements are those which electrical transmission is admirably adapted to meet. The falls of the Willamette River, at Oregon City, in the combined points of size, accessibility, and nearness to the seaport, are unequalled. These falls, estimated at from 200,000 to 250,000 horse-power, are about 13 miles from Portland, and it requires but a moment's thought to appreciate the value of an agent which can make this power available in the city.

"The Willamette River is about one quarter of a mile wide, and the fall is about 40 ft. The present station is located on an island at the middle of the river. Victor wheels of 300 horse-power are geared to horizontal shafts, from which the dynamo belts pass to an upper floor at an angle of 45°. Two alternating-current dynamos for incandescent lighting are driven by each wheel. The current, at a pressure of 4,000 volts, passes directly to the line of No. 4 B. & S. wire, which is carried on ordinary double-petticoat glass insulators across the level country to a sub-station in Portland. The current is received at 3,300 volts by transformers in the sub-station and is reduced to 1,100 volts, for distribution by various circuits through the city to ordinary transformers, by which it is reduced to 50 or 100 volts.

"When the apparatus was designed it was not considered practicable to generate 4,000 volts with the ordinary type of machine, in which the wire is wound upon the surface of the armature on account of the difficulty of insulating for more than 1,000 or 2,000 volts. The work was undertaken with a new type of armature, which is specially noteworthy, as it has rendered high potentials practicable in a machine of simple construction.



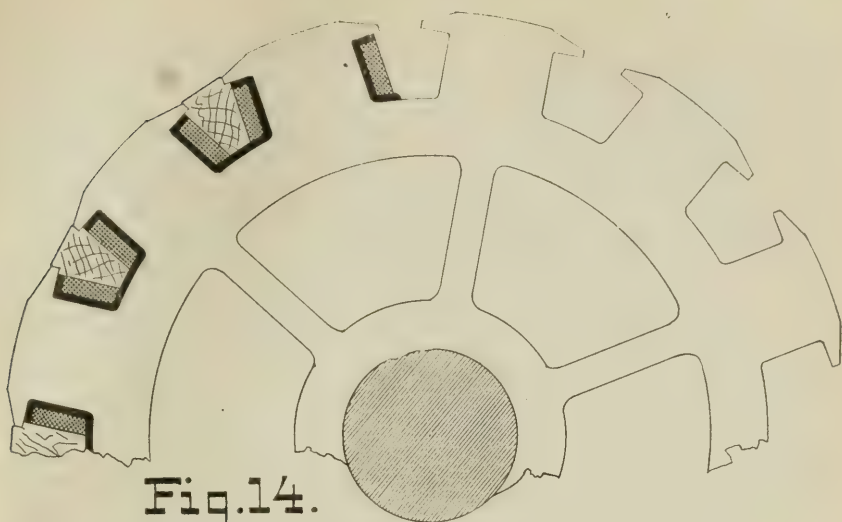


Fig. 14.  
Section of Armature, showing Iron Disk with three Coils in place.

"The field of the dynamo is of the ordinary type of alternating-current machine in use in this country. The casting is circular in form, with twelve inwardly projecting poles of laminated iron, on which the field-coils are placed. This type of machine combines simplicity with rigidity and strength, as both bearings and the lower field are in one casting.

"The armature is built up of laminated disks, which are punched with twelve T-shaped teeth. The armature-coils are wound in a lathe, are carefully taped and insulated, and are then placed over the teeth and sprung in under the projections. The space between adjacent coils is filled by a block of wood, which holds them in place securely. This form of construction gives all the advantages of machine winding over hand work, allows ample insulation between coils and core, protects the coils from mechanical injury, holds them in position without the use of band wires, and makes the replacing of a damaged coil comparatively simple. The field current is supplied from a direct-current machine, and the main current is taken from two collecting-rings on the armature-shaft. The reducing-transformers are placed in a vault in the sub-station at the city. They are arranged in banks or units of ten. Each bank is supplied by a separate dynamo, and has a capacity of 1,250 16-candle-power lights. The coils of the transformers are separately wound and taped, and are separated from one another and from the irons by strips of wood. The primaries are connected in series for receiving 3,300 volts, and the secondaries are in series for delivering 1,100 volts, so that there are 330 volts in the primary and 110 volts in the secondary of each converter. This method of connection throws small differences of potential in any single coil, and permits the use of conductors of good size. The necessity for special insulation is between the coils, where there is ample room for placing it. A transformer may be readily cut out of circuit by short-circuiting its terminals, and in case of an accident in which a coil becomes short-circuited, the E. M. F.

on that transformer disappears, and the others are called upon to do a larger share of the total work without interfering with service. The efficiency of the transformer at full load is 96 per cent.

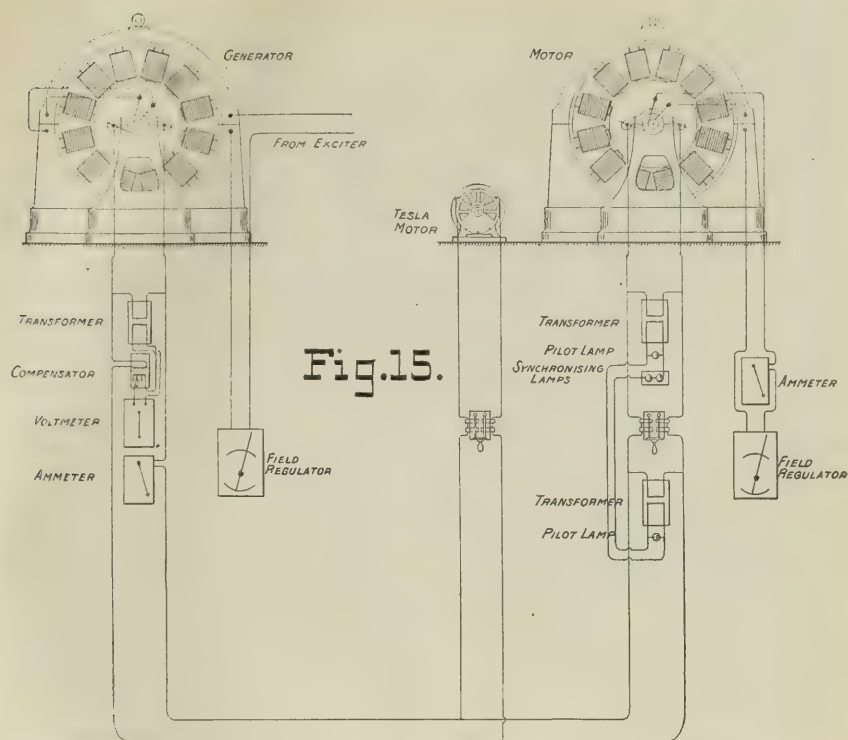
"The plant was first installed with two incandescent machines, and started nearly two years ago. Since that time five additional machines have been added, so that there are now seven, each with a capacity for supplying 1,250 16-candle-power lights, in Portland. The total capacity is 8,750 lights. The dynamos run admirably. There was one night when several armature-coils were burned out, which was attributed to an iron wire falling across the main line and connecting several of the circuits, grounding them. Otherwise there have been no difficulties to speak of with regard to the operation of the machines. The Superintendent of the plant states that the line has given very little trouble, much less than would ordinarily be expected from a city line. He also says that 'the converters in the sub-station have not given one minute of trouble, and have not cost one cent for repairs.' One explanation of the success of the plant is the intelligent policy of the General Manager, in harmony with his statement that 'It is not the first cost which counts, but the cost of throwing out and replacing apparatus.'

"The same policy has happily governed the installation of the second plant to be described—the power-plant. This is located near Telluride, Colo., and is owned by Mr. L. L. Nunn. The Gold King mill requires power for operating its crushers and stamps, and fuel can come only from long distances at enormous costs. A few miles from the mill there is a water-power, but the country between the two points is steep and rough, and for many months in the year is covered with snow. Electricity is the one means of getting the power from its source to the mill. The conditions are of the most favorable character for demonstrating the value and possibility of electrical transmission.

"In this plant a Pelton wheel, receiving water through a 2 ft. steel pipe, under a head of 320 ft., drives an alternating-current generator. The current is carried over a line of bare wire to the mill, which is nearly 3 miles distant, and drives an alternating-current synchronous motor of 100 horse-power. The generator and motor are machines of the same size and form of construction as the dynamos at Portland, already described, and differ from these only in some minor modifications.

"The generator is provided with a composite field winding. A part of the magnets are excited by direct current from a separate machine, and the rest are excited by a current from the generator armature, which is proportional to the main current, and is commutated by the equivalent of a two-part commutator. The adjustment is such that the E. M. F. on the main terminals rises as the current delivered by the machine increases, compensating for line-losses and keeping the pressure at the motor 3,000 volts. The speed is 833 revolutions, giving 10,000 alternations per minute. The switch-board and regulating appliances are similar to those in the station at Portland. Ordinarily no adjustment is required after the machine is started, and the attendant has little to do besides looking after the mechanical running of the apparatus.

"When the motor is running, the only things to be cared for are the brushes and the bearings. The high-tension brushes—the only point besides the switches where the high tension is exposed—will run for a



Synchronous Motor-Plant at Telluride. Diagram showing Apparatus and Connections.

week without adjustment, the exciter brushes run without sparking, and the lubrication of the bearings is well provided for. The construction and operation of the motor are strikingly simple in comparison with the steam engine, which it replaces, with its many moving parts and intricate motions.

"A few points illustrating the characteristics of the synchronous motor may be mentioned, as they are of both theoretical and practical interest. The connection of the motor to the generator is not a delicate operation. If the motor is running above synchronous speed at the time of connection with the generator, it instantly adapts itself to the proper speed. If the motor speed is slightly lower than that of the generator, it may fall into step when the switch is closed, but if it be running considerably slower it will not come into synchronism, but will further decrease in speed. When this occurs, the switch of the large motor is opened and that of the starting-motor is closed, bringing the machine up to full speed again without any injury to the apparatus. If the E. M. F. upon each of the machines before connecting them be 3,000 volts it will remain unchanged when they are connected. If the field-current of either machine be increased, the E. M. F. will be raised, but the field-current of the other machine may be lowered and the resulting E. M. F. made equal to 3,000 volts. The current flowing between the machines depends upon the relative field-charges, and is least, whatever the load may be, when the two machines are equally or very near equally



excited. The field-current of either machine may be made zero, and the motor will still run, but with greatly reduced capacity. In a test with machines of a smaller size the E. M. F. was 2,000 volts when the two field-charges were equal. When the field-charge of either machine was cut out it fell to 1,200 volts and the current increased very considerably.

"The efficiency of the synchronous motor system, leaving out loss in conductors, but including losses in generator and motor in the plant for the delivery of 50 horse-power, was found to be  $83\frac{1}{2}$  per cent at full load, and 74 per cent at half load.

"Full load may be thrown on the motor suddenly. In the Gold King mill the stamps, which are operated by the motor, are usually left raised when the plant is stopped, in order to avoid the extra strain of lifting them when the plant is started. It sometimes happens that the stamps are left down and the motor is required to raise them all at once. When the clutch is thrown in, the current indicates that the load is considerably above the normal capacity of the motor, and yet it is started without difficulty or apparent strain.

"The excellent current regulation with different loads, the tendency of the machines to normal adjustment when there is ordinary variation in the field-currents, the small liability to injury when the motor is greatly overloaded, the high efficiency and ease of attendance, are points of great value in the practical operation of the system.

"The pole-line runs from the power station up the mountain to a height of 2,500 ft., and then crosses a rough but comparatively level country to the mill. The line at some places is at an angle of  $45^\circ$ , and many of the poles had to be set in solid rock. The surface of the snow in winter is occasionally at a level with the tops of the poles, and parts of the pole-line are practically inaccessible during some months of the year. This region is peculiarly subjected to lightning discharges, and special precautions are necessary to protect the apparatus. In one instance there were forty-two discharges of the lightning-arresters in as many minutes.

"The plant was started for regular work in June of last year. An accurate record was kept from the middle of July to the first of May, showing the actual number and the length of the delays caused by electrical machinery. During these nine and a half months the system was in regular continuous operation six and a half days each week, with but few intermissions. The difficulties which were encountered were insignificant in amount and have resulted, not from any fundamental difficulty in the system, but have been caused by incidental defects or accidents which usually indicated their own remedy. The stops due to the electrical machinery resulted from a variety of causes, and comprised the replacing of an armature-coil damaged by lightning, renewing of fuses, fixing loose contacts, the examination of the line after a storm, and sundry other slight mishaps. The aggregate time lost on account of the electrical apparatus was, by actual count, less than 48 hours during three fourths of a year. A recent report from the Superintendent of the plant, covering the time from December 13th to May 1st, shows that the plant was running 127 days with a loss of  $19\frac{3}{4}$  hours, or, as he puts it, an average of about nine minutes in a day of 24 hours. Although the plant was generally shut down each week for 12 hours on Sunday, this was not practicable during a part of the winter, and the motor on

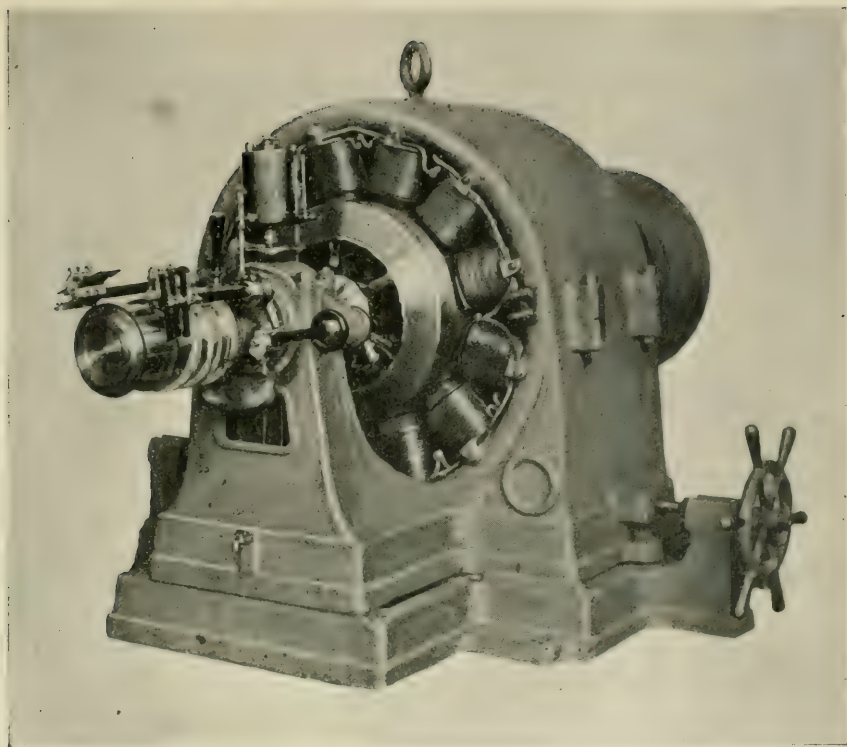


Plate VIII. Machine used as Generator and Motor at Telluride, Colorado.

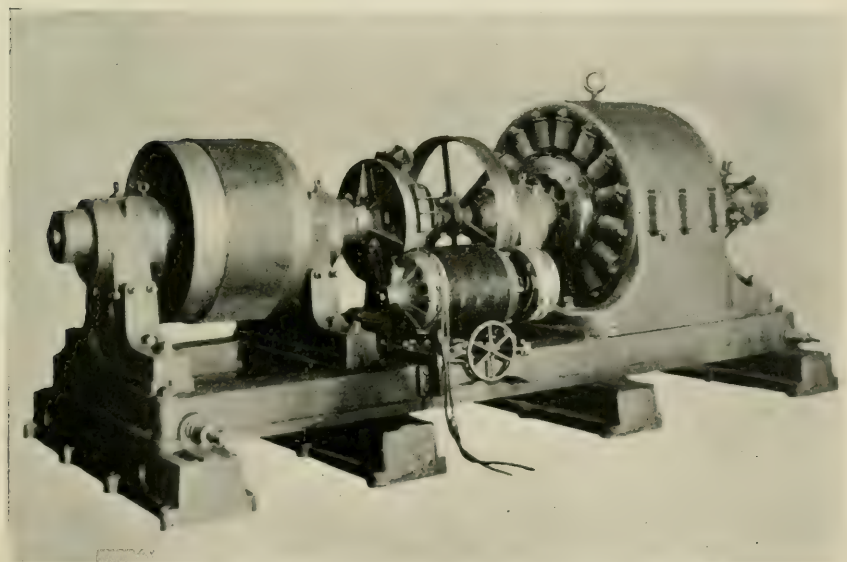


Plate IX. New Motor at Telluride, Colorado. 250 horse-power.





one occasion was run continuously for 27 days without any stop whatever. Such a record as this, with a new type of machinery, in a country where line construction and maintenance are peculiarly difficult, with practically continuous service, with attendants who were not electricians, with a high voltage, a considerable distance and large power, places transmission by the alternating-current synchronous system beyond the stage of experimental trial and gives it the stamp of commercial success.

"This success is confirmed in a substantial way by the immediate extension of the plant. A 50 horse-power motor is now being installed at a mill a few miles from the Gold King; an order has been entered for a 750 horse-power generator to be located in the power station; and a 250 horse-power motor for operating a mill about 10 miles distant. Lighting at Telluride, 8 miles from the station, which has been done heretofore on a small scale on a circuit from the power generator, is being extended.\*

"The large generator is a new design and is notable, as it has more than three times the capacity of any alternating-current dynamo previously made in this country. Two machines of this size have been running for some months for incandescent lighting at St. Louis.

"This dynamo is of a type similar to the machines at Portland and Telluride. The field has twenty-eight poles, requiring a speed of 570 revolutions for 16,000 alternations, the conditions of running at St. Louis, and 357 revolutions for 10,000, as it will be operated at Telluride. The armature has T-shaped teeth, as in smaller machines. The diameter of the armature is slightly over 4 ft. and its length is about 2 ft. There is a third bearing at the end of the shaft outside of the pulley to relieve the other bearings from the severe strains resulting from belt tension. The total height of the machine is 8 ft., and its weight is 40,000 lbs. The electrical efficiency at full load is over 95 per cent.

"The extension of alternating-current working, both for lighting and power, by the use of large machines, is therefore already provided for.

"The extension to greater distances is largely a question of E. M. F. Nearly every one is familiar with the rapidity with which the cost of copper diminishes as the voltage is increased. If the cost be \$100 with 500 volts, it will be \$25 at 1,000 volts, and \$1 at 5,000 volts. The higher the tension, however, the greater the difficulty and cost of construction, and the greater the liability to accident with apparatus and line. There are a few points in connection with this subject which may be noted without entering into a general consideration of it.

"The smallest size of wire that can well be used for line work on account of its mechanical strength is about No. 6 B & S. This wire will transmit with 20 per cent loss 100 horse-power 10 miles at 4,000 volts, or twice the power half the distance. Unless these distances or powers are to be exceeded, an increase in pressure would result in no saving in copper, but simply in a less line-loss, which is already not excessive.

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\* NOTE, May, 1893.—Since this paper was read the 750 horse-power generator, the 50 horse-power motor, and the 250 horse-power motor have been installed and put in operation. (See Plates VIII and IX.) The order has been placed for an additional 75 horse-power motor. A letter from the engineer of the plant, dated April 20, 1893, contains the following: "The generator runs very nicely indeed. The motors are running very satisfactorily. The 250 horse-power is running very nicely at the present time. The 50 horse-power has been running about a week since the winter shut-down, and the 100 horse-power motor, which has been idle during repairs to the mill, is expected to start within two weeks. When we get the 75 horse-power motor and start it, we will feel that we have quite a system in operation."

"The use of 4,000 volts at the motor and a line-loss of 20 per cent requires an outlay for copper of only about 10 to 15 per cent of the total cost of the plant when the distance is 10 miles. Unless, therefore, the cost of copper is to bear an insignificant proportion of the total cost, it is unnecessary to exceed this pressure unless the distance be greater than about 10 miles.

"These simple considerations show that pressures practically the same as those employed in the plants which have been described are ample for considerable distances. The same type of apparatus which has been successful in them is available for larger capacities. The fundamental elements required for electrical transmission in a very wide range of cases have therefore been tried and their success demonstrated.

"For considerably longer distances, where pressures higher than about 5,000 volts are required, good practice indicates the use of transformers for raising the pressure at the generator and reducing it at the motor, similar in general to those employed at Portland. The increased pressure thus available greatly reduces the cost of copper required, and this reduction must, of course, be more than sufficient to cover the cost of the transformers.

"The simplicity and flexibility and range of the alternating-current system make its possibilities the sole dependence of the largest enterprises toward which the public and engineers are looking. The records of the plants at both Portland and Telluride demonstrate that these possibilities are being realized, and that work in this field is fast passing from experimental investigation into practical electrical engineering."

#### PROTECTION AGAINST LIGHTNING.

The protection of these circuits against lightning is a very important matter. The mountainous regions in which the majority of mines are located are generally subject to severe thunder-storms and electrical disturbances, and therefore to the miner using electrical power, it is of vital importance to have his apparatus protected from damage from such causes; while many may be deterred from undertaking the installation of electric transmissions through fear of lightning interfering too seriously with their successful operation.

During the past year much trouble has arisen at Bodie from this cause; the machines running smoothly and perfectly for several weeks, when a storm would occur, oftentimes without visible lightning or audible thunder, but causing a burn-out of armature-coils in generator or motor.

Lightning-arrester houses have been built at each end of the line close to the power-house and motor-room, and these fitted up with banks of spark-gap-arresters and choke-coils precisely as outlined by Mr. Alex. J. Wurts in his article on "Discriminating Lightning-Arresters and Recent Progress in Means for Protection against Lightning" (in the "Electrical Engineering Magazine," May 23, 1894), since which time but little trouble has been had.

Our experience was so similar to that of Mr. Wurts with the plant of the San Miguel Consolidated Gold Mining Company, at Telluride, Colo., and so much interesting and valuable information on the subject is given in the above-mentioned article, that the writer takes the liberty of quoting Mr. Wurts in full:

*An Experiment with Lightning-Arresters on a 3,000-Volt Alternating-Current Circuit.\**

"During the winter of 1892 and 1893 I made a searching investigation of this subject, experimenting with disruptive discharges and various kinds of combinations of apparatus which might promise advantageous results, and since that time have spent nearly six months in the State of Colorado—a land of thunder-storms—testing the various forms of apparatus which I had designed as a possible protection against lightning.

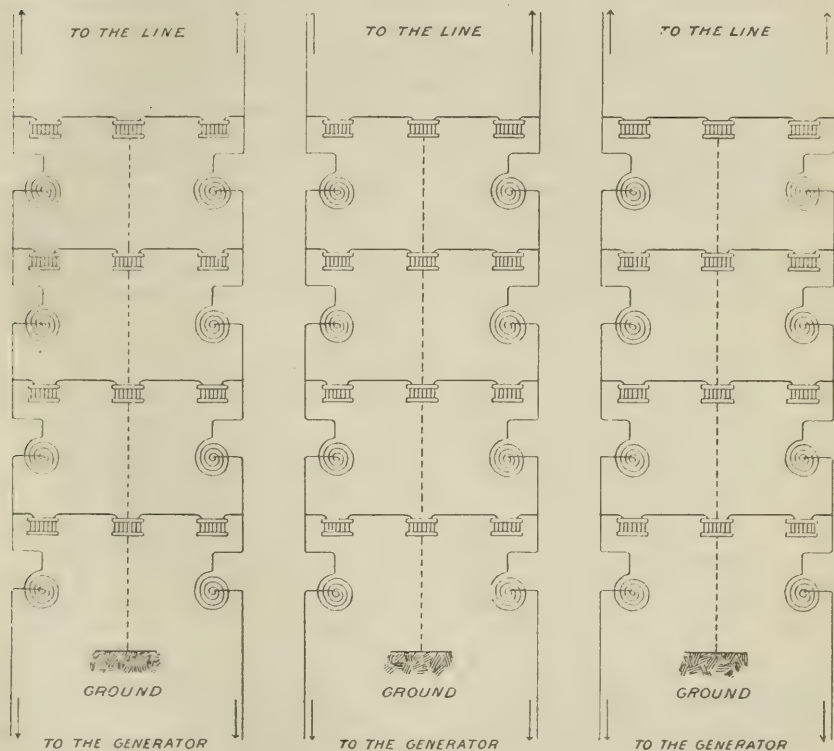


Fig. 16.

"The general requirements of efficient lightning-arrester apparatus are: (1) To provide discharge circuits which shall operate automatically and repeatedly, and which shall with certainty avoid dynamo short-circuits or interruption of the system. (2) To provide discharge circuits, or so install them that they shall invariably offer a certain path to ground for disruptive discharges in preference to any other part of the system. It follows also from this last, and as a matter of practical experience, that ground-discharge circuits should be short and straight,

\* Abstract of a paper read at the eleventh general meeting of the American Institute of Electrical Engineers, Philadelphia, May 15, 1894.



The matter of proper earth connections at the terminals of the ground-wires from these lightning-arresters is most important. The common idea that a rod of iron stuck into the earth a couple of feet, or a piece of old iron thrown into the bed of a stream, forms a good "ground" is most erroneous, as has been proven by our experience at Bodie. In reality, such form the poorest kind of earth connection.

The ground-wires from the banks of arresters are carried into a pit dug directly underneath the arrester-house. This pit is about 4 ft. square and reaches to permanently moist earth at the power station, while at the mill, since no damp ground was found at a reasonable depth, it was necessary to carry a  $\frac{1}{4}$  in. pipe into the pit through which water is occasionally allowed to run. On the bottom of the pit a layer of small charcoal 2 ft. in depth was laid, and on this placed a plate of copper  $\frac{1}{16}$  in. in thickness and 6 sq. ft. in area. To this plate the ground-wire was securely soldered in a spiral coil, and another layer of charcoal placed on top of it, after which the pit was filled up with loose dirt. This makes an efficient ground, and gives the necessary surface for the rapid dissemination of the electric discharge.

Inductive resistance-grounds have also been added at either end of the line, with the object of preventing damage to the machines through static charges, by leaking them to earth as fast as accumulated. They are connected to each side of the line as shown in sketch, and their resistance is sufficiently high to prevent any appreciable loss of current.

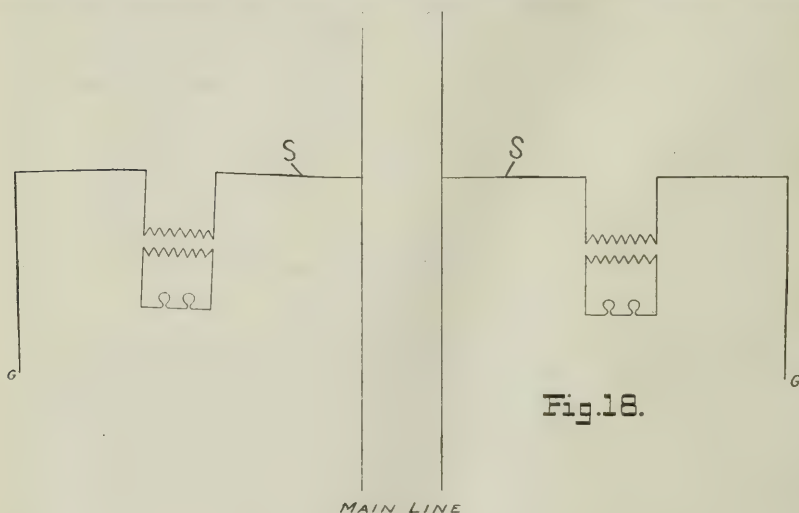


Fig. 18.

Two 50-volt lamps in the secondary circuit of each "resistance" burn at a dull red when the switch S is closed; as is the case at all times excepting during thunder-storms. During such these grounds are taken off in order to prevent danger of burning out the primaries.

These inductive resistances are chiefly of service during wind-storms, when the line is most liable to cumulative charges from the atmosphere.

## ELECTRICAL TRANSMISSION PLANTS AT PRESENT IN OPERATION.

The following short descriptions of electrical power plants in operation have been culled from various sources, many of them from the article by W. H. Adams in "Engineering and Mining Journal," June 23, 1894:

*Electric Generating Station at Tivoli.*—In a lecture delivered by Prof. J. A. Fleming, at the Royal Institution, the following description was given of a plant used in transmitting 2,000 horse-power from the Falls of the Anio, Tivoli, for 18 miles over the Campagna to Rome: "From the upper levels of the Anio an aqueduct has been led which delivers water to the top of an iron pipe 150 ft. above the power-house. This power-house is placed about halfway down the declivity on which are situated the famous cascades of Tivoli. The pipe is about 2 meters in diameter and can deliver 100 to 150 cu. ft. of water a second with a head of 150 ft., or nearly 2,000 horse-power. The water is conducted to a series of nine Girard turbines, six being of 350 and three of 50 horse-power. The six larger ones are directly connected with Ganz alternators, which generate a current of electricity at a pressure of 6,000 volts, while the three smaller ones are used to drive the excitors. The current is conveyed to Rome by four cables carried on 760 posts, which are placed in a straight line across the Campagna. Outside the Porta Pia, at Rome, it enters a transformer-house, where its pressure is reduced from 5,000 to 2,000 volts. Part is then used for arc lighting in the streets of Rome, and the rest is distributed by underground cables to various other centers, where it is again transformed down to a pressure of 100 volts for use in houses. About 20,000 incandescent lamps are thus supplied with current."

*Compagnie de l'Industrie Electrique, Geneve, Switzerland.*—Four hundred horse-power transmitted 20 miles by continuous currents, potential between 6,000 and 7,000 volts. One 400 horse-power turbine, under fall of 14 meters, revolves on vertical shaft at 120 revolutions per minute, and drives by means of bevel wheels and pinions two dynamos, placed one on each side. Commercial efficiency of the dynamos reaches 93 per cent, with a weight less than  $7\frac{1}{2}$  tons. Commercial efficiency of the installation from shaft of the turbine to the motor shafts exceed 75 per cent at full load. Bare copper conductors are used in line construction, 7 millimeters in diameter, the line being entirely aerial through mountainous country between Frinvilliers and Bieberist.

A plant at *Oynuaux, France*, has been working satisfactorily for some time with two turbines of 150 horse-power each. A generator of 105,000 watts capacity at 2,000 volts is directly connected to each turbine. Distance between generating and receiving station about 8 kilometers, and 76 per cent efficiency is obtained in the transmission.

At *Chambery*, 2,000 horse-power is about being installed with water-fall 2,040 ft. high. There are to be seven alternators, each of 120 kilowatts at 5,000 volts.

The two waterfalls about 25 miles from *Christiania, Norway*, are about to be utilized for power transmission, at a total cost of \$1,500,000. The voltage will not exceed 20,000, to be carried on bare wire on poles carefully guarded over the entire distance.

The *Portland General Electric* power plant, at Oregon City, Oregon, 12 miles from the city of Portland, on the Willamette River, will install 12,000 horse-power, using twenty Victor 42 in. and twenty Victor 60 in.

turbines, under 30 and 48 ft. head. Many new features in tri-phase transmission are promised for this plant, one half of which is now being installed for service during the coming year.

In the Baltic mill, on the Shetucket River, about 5 miles above *Taftville, Connecticut*, the General Electric Company has lately installed a three-phase power transmission plant of 1,500 horse-power, using three double 42 in. horizontal turbines, developing 800 effective horse-power each at 157 revolutions per minute, and one double 27 in. turbine developing 300 horse-power at 244 revolutions per minute.

The efficiency is just 80 per cent from power applied to dynamo pulley to delivery at motor pulley at *Columbia, South Carolina*. The Columbia Cotton Mills Company is about starting a plant of 1,400 horse-power, using two pairs of 48 in. Victor turbines on a horizontal shaft, and a single 24 in. turbine for fire pump. The 48 in. turbines are connected together, and at each end are directly connected to a generator of 700 horse-power capacity. This is the second instance in this country where an entire cotton mill is driven by electricity. The generators, made by the General Electric Company, weigh about 100,000 lbs. each; the armature is 10 ft. in diameter, 500 kilo-watts capacity, and operates at a speed of 108 revolutions per minute.

*Concord Land and Water Power Company, Concord, N. H.*, has utilized 2,000 horse-power of the 5,000 horse-power, furnished by the new dam located at Sewall's Falls. Horizontal turbines are used with draught tubes, thus avoiding gears, the power being transmitted from each pair of wheels to the shafting in the generator-room by belts. The shafting is arranged with quills and clutches, in order that any wheel or section of shaft may be run independently of any other. The pulleys used on shafting are extra heavy, and fly-wheels are being tried for the first time at this location for inertia regulation. Six tri-phased generators are to be installed, two being now in operation, of 250 kilo-watts capacity and separately excited, and run at a speed of 600 revolutions per minute. The current is generated at 2,500 volts; the line runs to the center of the city, about 3 miles, where tri-phased current of a frequency of 50 is delivered to the mains at 2,200 volts pressure. It is then transformed to 110 volts for delivery to consumers, being sold by meter at 20 cents per kw.-hour for lighting and 10 cents per kw.-hour for power, heating, and cooking.

#### *Colorado.*

*The Roaring Fork Electric Light and Power Company, Aspen.*—Pipe-line, 500 ft. of 16 in., 3,500 ft. of 14 in. Power plant: eight 24 in. Pelton wheels, 1,000 revolutions, under a head of 820 ft., equal to 175 horse-power each; total, 1,400 horse-power. The light plant supplies the entire town of Aspen, as well as many mills, mines, and sampling-works. The power plant supplies 120,000 watts, and is used for operating mills, hoists, pumps, and tramways within a radius of 3 to 4 miles from the generating station. The plant has been in continuous operation for five years, with practically no expense in the way of repairs or interruption of the service.

*Aspen Mining and Smelting Company's Plants.*—Flume, 1,300 ft. long, head 80 ft.; two 50 horse-power Thomson-Houston dynamos, equal to 100 electric horse-power; generating station, 6,000 ft. from tunnel entrance. The underground motors are located 1,000, 1,200, and 1,800 ft. from the entrance. Power used for hoisting.



New works of the *Roaring Fork Company*. Two pipe-lines: 2,500 ft. of 26 in. pipe, head 312 ft.; 4,300 ft. of 24 in. pipe, head 330 ft. Power plant: five 60 in. Pelton wheels, 30 revolutions, 250 horse-power each; total, 1,250 horse-power. Distributes power 5 miles distant.

*People's Electric Light and Power Company*, on Castle Creek, 1 mile from Aspen. Power plant: two 5 ft. double-nozzle Pelton wheels, 300 horse-power each, 240 revolutions, 180 ft. head; also two 3 ft. double-nozzle Pelton wheels, 75 horse-power each, 345 revolutions. Power and light furnished to mills and mines within a radius of 3 miles.

*Virginus Mine Plant*.—Pipe-line, 4,000 ft., head 485 ft. Power plant: two Pelton wheels, one 5 ft. and the other 6 ft. in diameter, 500 and 700 horse-power, respectively; total, 1,200 horse-power. Electric generating plant: 293 horse-power; line, 4 miles long. Machinery operated at the mines: 2 pumps (one 60 horse-power and the other 25 horse-power), one 15 horse-power blower, two 60 horse-power motors for running concentrators and stamp mills. Previous to installation of the electric plant the outlay for coal alone was \$40,000, at \$18 per ton.

*Telluride—San Miguel Consolidated Gold Mining Company's Plant*.—Power plant: 6 ft. Pelton wheel, 3,900 ft. of 24 in. pipe-line, 320 ft. of head; 1,100 horse-power dynamos, supplying power to three stamp mills, 2, 3, and 10 miles distant, and also lights for the town of Telluride, 8 miles distant. The pole-line is 8,800 to 12,000 ft. above sea-level. The cost of maintenance, including wages at power plant, was given at \$3,060 for the first year. The repair account was \$21, occasioned by lightning. Since the introduction of lightning-arresters there has been no damage from this cause.

*Sheridan & Belmont Company*.—Water-head, 235 ft.; Pelton wheel, 28 in.; electric circuit, 12,300 ft., furnishing 250 to 300 lights, and two motors of 10 horse-power and 5 horse-power.

*Belmont Consolidated Mining Company*.—Head of water, 670 ft., capable of developing 210 horse-power, with a 36 in. Pelton wheel. In the mine are two 30 horse-power motors. Length of line, 2 miles. Loss between generators and motors, 8 per cent.

### Washington.

*Walla Walla Electric Power Plant*.—Pipe-line, 5,800 ft. of 48 in. pipe; two 80 in. Pelton wheels; two A-100 Edison 2,000-volt machines.

### Idaho.

*Cœur d'Alene Silver and Lead Mining Company*.—Pipe-line, 3,000 ft.; head, 850 ft.; two 3 ft. double-nozzle Pelton wheels. Has replaced all steam machinery at the mine, with a saving of \$40,000 per year.

Mr. Clark, General Manager of this company, writes in reference to this plant as follows: "In respect to the relative merits of steam and electricity at the Poorman Mine, I will say that the amount saved in fuel is about \$100 a day. This, of course, is due to the fact that we generate electricity by water power. How electricity would compare with steam in the matter of cost, if the former was generated by steam power, I am not prepared to say, but am of the opinion that where steam has to be transmitted a long distance underground, particularly where it is wet, that electricity generated with steam and transmitted to the pumps or other machinery will be found to be the most econom-

ical, the percentage of loss in transmission being so much less; in addition to this, the cumbersome steam pipes, with their destructive effect on shaft timber, is avoided. We have five machines in use: two 175 K.-W. at the generating station  $1\frac{1}{2}$  miles distant from our works, where they are operated with Pelton wheels under 800 ft. head; one 175 K.-W. to drive our concentrator; one 150 K.-W. T.-H. machine for the pump, raising 500 gallons of water per minute 500 ft.; and one 175 K.-W. for the compressor. This system has been almost two years in operation, and my experience in that time is that an electric machine to run continuously, as in operating a mine pump or mill, must have at least double the capacity it would require when stops occur—as on a street car, for example.”

The greatest departure, however, electrically, is the installation at this mine of an 80 kilo-watt, 1,200-volt motor for driving a Knowles double-acting pump, having a capacity of lifting 500 gallons 500 ft. high per minute. The current for the motor is conducted down the shaft through which all the steam pipes, air pipes, etc., are taken, by two Siemens (lead, iron band, iron wire, armored) cables—C. L. A. T. W. The iron wire armoring of these two cables is so connected and arranged as to prevent any shocks due to static charges, should workmen come in contact with the cables.

The regulation of the speed of the motor is effected by placing in armature-circuit of motor a rheostat of two or three ohms capacity. The motor drives the pump through a counter-shaft and wooden-toothed gear and bronzed pinion. The crank-shaft of pump makes from 36 to 46 revolutions per minute as desired.

This is the first installation of a 1,200-volt motor placed in a mine for pumping purposes. The mine and mill are lighted by incandescent lamps from a 110-volt Edison dynamo belted from main shaft of mill.

#### *California.*

*The Dalmatia Mine Plant in El Dorado County.*—The power station is located on Rock Creek, some 1,500 feet below the mine and mill, and 2 miles distant in a straight line. The plant consists of an 8 ft. Pelton wheel, which, running under a head of 110 ft. at 100 revolutions, with a  $5\frac{1}{2}$  in. nozzle, has a maximum capacity of 130 horse-power. To this wheel is connected a 100 horse-power constant-current Brush generator—30 amperes—speeded at 900 revolutions, the current from which is carried to the mill through a single insulated copper wire, No. 3, B. & S. gauge, the return being made by a wire of the same size, making a 4-mile circuit. The power from the generator is communicated to the counter-shaft of the mill by a 70 horse-power motor running at 950 revolutions. The machinery operated consists of three Huntington mills, a 10-stamp battery, and a rockbreaker. The Pelton wheel under these conditions shows an efficiency of 86 per cent, while about 75 per cent of the power thus generated is available for duty at the mill. Sufficient power is taken from the main circuit to run sixty incandescent lamps for lighting the works, office, and residence of the manager. The mill handles an average of 4,000 tons of ore a month, effecting a saving of some 60 per cent over the former method of working by steam power, while the cost of maintenance is about as six to one in favor of electricity. An extension of this line has recently been made to the St. Lawrence

Mill, similar in character to the Dalmatia—located 3 miles from the latter and 5 miles from the waterwheel station—which is operated by Keith generators and motors. This is an exceptionally long distance for a continuous-current transmission.

*The San Antonio Electric Light and Power Company in Southern California.*—The power plant is located in San Antonio Cañon. The water is brought to the power station through 1,900 ft. of 30 in. and 600 ft. of 24 in. double-riveted sheet-iron pipe, giving 300 ft. effective head or running pressure. The power station is provided with four double-nozzle Pelton wheels, 34 in. in diameter, coupled direct to the armature shafts of as many Westinghouse alternating-current generators of 200 horse-power each. The wheels run under above conditions 600 revolutions per minute, giving the same speed to the generators. Two exciters are provided, which are also run by Pelton wheels coupled to the shafts in the same manner, and of 20 horse-power each. The current thus generated is carried on two No. 7 bare copper wires 7 miles down the cañon to a point where they diverge, one running to Pomona, 15 miles, and the other to San Bernardino, 28 miles, covering by the return circuit in the latter case a distance of 56 miles. By means of transformers the potential is raised at the generating station to 10,000 volts, and the current carried at this pressure to sub-stations located just outside the cities named, where, by means of step-down transformers, it is reduced to about 1,000 volts and then distributed for both light and power purposes.

*Amador County—The Gover Plant.*—A 3 ft. Pelton wheel, 340 ft. head, speed 470 revolutions, works two Dow pumps of 15 horse-power and 20 horse-power, which handle 200,000 gallons of water per day.

*Plant at Redlands, San Bernardino County.*—This is a three-phase plant, recently installed by the General Electric Company; distance of transmission, 5 miles; two A. C. generators, of 250 K.-W. each, driven by four 30 in. Pelton waterwheels, at a speed of 600 revolutions. The generators carry a potential of 2,450 volts and the motor about 2,150, the line-loss being approximately 12 per cent. The three No. 0, bare copper wires (insulated within city limits) are carried on deep-groove, double-petticoat glass insulators. The line poles are 35 ft. long, 6 ft. in the ground, and set 110 ft. apart. The one motor at present in operation is a synchronous high-potential machine of 150 horse-power, and has continuous work to perform in driving the ice machines of the Union Ice Company. The initial current in the fields of the motor is generated by a small exciter, and the motor is self-starting only under light load, the full load being thrown on after the machine is up to speed.

#### Nevada.

*The Chollar Plant.*—This, one of the earliest applications of electricity to mining work, has already been so fully described in the mining and technical papers that it is not necessary to repeat the details.

#### Arizona.

*Plant of the Commercial Mining Company.*—This plant consists of a 4 ft. Pelton wheel, which runs, under a 1,200 ft. head, at 699 revolutions a minute, developing 45 horse-power, using a nozzle tip  $\frac{5.3}{100}$  in. in diameter; also a 24 in. Pelton wheel running, under the same head, at 1,380 revo-



lutions, developing 20 horse-power, with a nozzle tip  $\frac{3.5}{100}$  in. diameter. These wheels run a concentrating and smelting plant, including rock-breaker, blowers, pump, etc. The pipe-line is 20,000 ft. in length, the upper end being 6 and 5 in. casing, and the lower end 5 in. lap-weld pipe.

#### ELECTRICITY IN UNDERGROUND OPERATIONS.

This power was applied earlier and has been more widely used in the coal measures than in lode or precious metal mining; hence, in the former we find many coal mines fitted with extensive and efficient electric haulage systems and lit by electricity, while their drills and coal-cutters are operated by the same power.

Electric locomotives are now built no larger than the cars they are to haul, and made to conform to any gauge of track from 18 in. upwards, effecting a great saving in the size of entries required for narrow coal seams. That they do not vitiate the air as do steam motors is a great point in their favor.

For the operation of undercutting machines, haulage, and general coal mining work, the direct-current is usually employed, since it can be generated cheaply at the pit's mouth, and the underground workings are not usually of such length as to increase unduly the cost of conductors.

It is not invariably employed, however, as instanced in the First Pool Mines at Benola, on the Monongahela River, where an A. C. three-phase plant was installed several years ago. The generator is of 100 horse-power, Tesla type, operating under 500 volts. The three wires are carried underground for  $2\frac{1}{2}$  miles along the main entry. Clark's insulated wire, No. 2, is used, and branches are carried to the various chambers to operate McMichael's undercutting machines working in the bituminous coal-seam from 6 to 8 ft. wide. The current is used for lighting also, in 16 candle-power incandescent lamps.

New electric coal-cutters are continually being put upon the market,\* and the improvement in these machines and the introduction of electric pick-machines for hard coal, typifies the rapid advance in the application of electricity to mining work.

In metal mining, electricity has thus far been employed chiefly for pumping and hoisting, though its field will undoubtedly be greatly extended within the next decade.

While it is reported that electric percussion drills are at present in successful use, and exposed to the same hard usage as the air drills,† the writer has not yet been fortunate enough to witness such nor to obtain details of their operation underground.

The use of electricity, however, certainly admits of a great saving in the transmission from air-compressor to drills, by the placing of the former underground and closer to the stopes and headings.

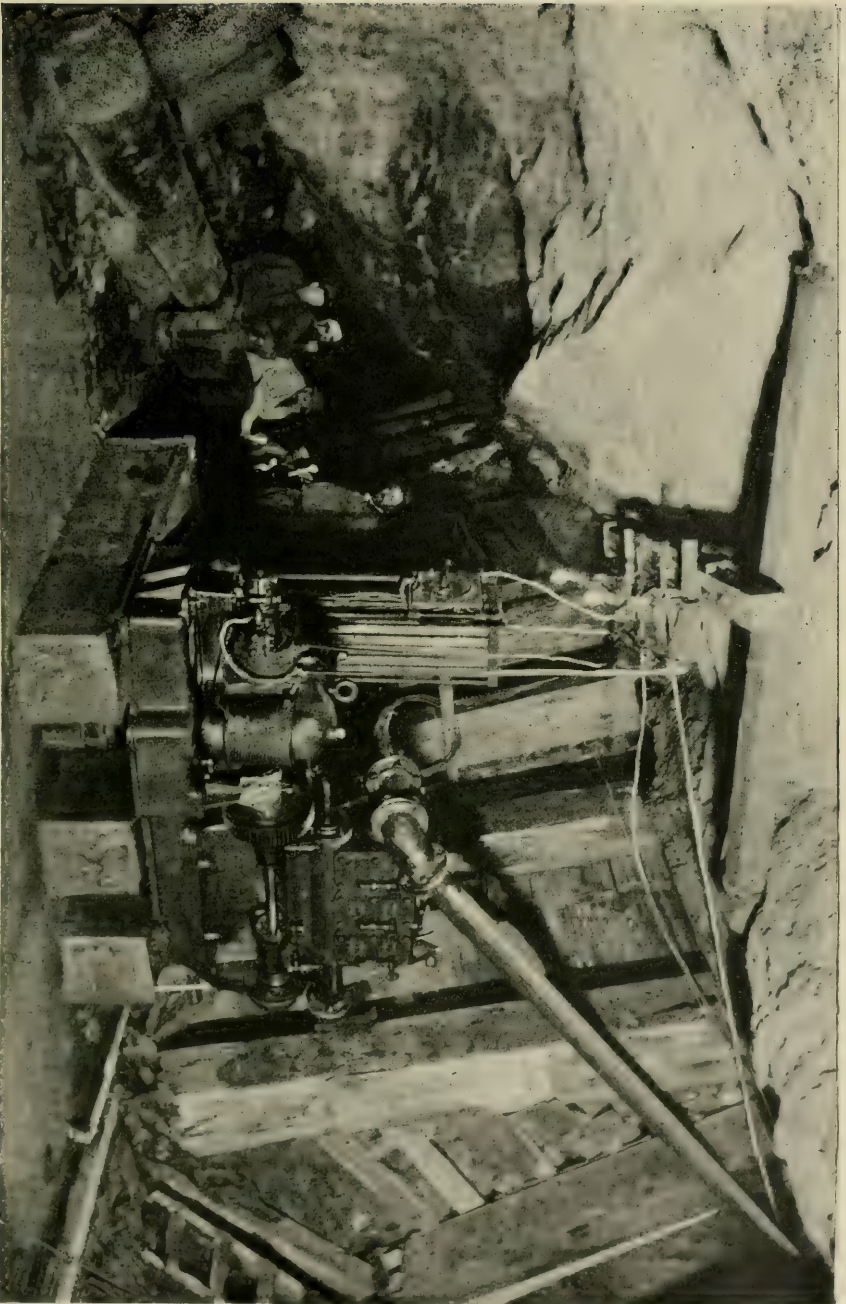
That motors are now made that will operate as successfully underground and in damp places, as upon the surface, is conclusively shown by the number of pumps at work in wet shafts to-day. By this it is not meant to say that wet electric motors will operate, but that these are now so insulated and protected that they successfully exclude the moisture of wet shafts and damp foundations.

A most excellent instance of this we have at hand in Superintendent

\* See "Engineering and Mining Journal," June 16, 1894, p. 559.

† Trans. Am. Inst. M. Engineers, vol. xxiii, p. 405.

Plate X Electric Pump on fifth level, Gover Mine, Amador County, California.







Call's letter to the writer, descriptive of the Gover Mining Company's (Amador County, Cal.) plant, as follows:

"Two triple-plunger Dow pumps are used—one with 6 in. plungers raising  $12\frac{1}{2}$  miner's inches of water 341 ft. vertically, and one with 5 in. plungers, raising 11 miner's inches of water 208 ft. vertically.

"An Edison dynamo, No. 16, of 50 horse-power capacity, is used, and run at a speed of 820 revolutions per minute, the voltage being 220.

"Sprague motors are used. The one working the larger pump is run at a speed of 1,000 revolutions per minute, giving 20 horse-power; and the other is run at a speed of 1,250 revolutions per minute, producing 15 horse-power. The voltage in the motors is the same as that of the dynamo.

"Copper wire  $\frac{5}{16}$  in. in diameter transmits the power from the dynamo to the motors, a distance of about 1,700 ft.—1,000 ft. on the surface, and 700 feet down the shaft. (See Plate X.) The wires cause no trouble whatever in the shaft, retimbering even being done without stopping the pumps. The shaft is quite wet in places.

"The pumps have run three years and four months, pumping during that time 59,000,000 gallons of water.

"The armature of the dynamo burnt out once, owing to injuries received in shipment, the core being shifted. The commutator of the dynamo is turned down about once a year.

"The motors are connected with the pumps by gearing. Rawhide pinions are used on the armature shafts. The rawhide pinions last a year, and are more reliable and more satisfactory than those made of bronze.

"With the motors, the only precaution taken against dampness is a thorough coat of paraffine paint. The smaller motor was run at one time for several hours with the field piece half way under water."

In hoisting, electricity has thus far been applied chiefly to inclines and used in motors of comparatively small capacity or from 10 to 40 horse-power, but its field will undoubtedly be extended to vertical shafts and larger machines as its advantages become more widely recognized.

In the mines of the Aspen Mining and Smelting Company, at Aspen, Colorado, three hoists are in operation underground, each of the two main hoists raising 250 tons up a  $60^\circ$  incline 250 ft. long every twenty-four hours. A 25 horse-power motor in use there raises 3,000 lbs. up a similar slope 275 ft. per minute, and is capable of making the round trip from a depth of 550 ft. in three minutes.

This plant was installed three years ago, and direct-current machines are used throughout. The rapid development of the A. C. systems during the past few years has demonstrated the advantages of the two-phase current for both transmission of the power and the accomplishment of a variety of work at the delivery end of the line.

This is shown in the following description from the "Colliery Guardian" of the recent installation of such a plant at the Decize collieries in France. A noticeable feature, and one already alluded to as a decided advantage of the system, is the ready regulation of varying load on the two currents:

"One of the most interesting cases of the electrical transmission of power for coal-mining purposes in Europe has been completed and set in operation at the Decize collieries, in the Nièvre Department of France, and which are owned by MM. Schneider & Co. This installation is remarkable from the fact that diphas alternating-currents are employed

for the transmission, and diphasé alternating-current motors are used for reconverting the electrical energy into mechanical power at the different pits. In designing this plant the problem to be solved was to erect a central generating station for the distribution of electrical energy at the different pits where it could be utilized in electro-motors for operating ventilating fans, hauling machinery, pumps, and for lighting purposes. A general idea of what had to be accomplished is shown in the annexed table:

Site.	Distance from Generating Station—Yards.	Electrical Machinery or Lamps Receiving the Current Transmitted.
1.—West.		
Puits des Chagnats .....	5,090	30 horse-power electric motor.*
Fendue des Lacets .....	3,466	30 horse-power electric motor.*
Puits des Coupes .....	2,058	30 horse-power electric motor.*
Puits des Zagots .....	1,084	Electric hauling machine of 15 horse-power.†
2.—Generating Station.		Six arc and 100 incandescent lamps.‡
Various installations .....		
3.—East.		
Fendue des Marizy .....	1,300	30 horse-power electric motor and 24 arc lamps.§
Sorting and washing shops of the Pré-Charpin .....	2,490	500 incandescent lamps of 16 candle-power.‡
Champvert .....	3,250	12 horse-power electric motor.¶

\* Used for ventilating fan. † Inclined plane. ‡ Lighting. § Ventilating fan and lighting. ¶ Pumping.

"The generating station is situated, respectively, at distances of from 3.1 miles and 1.86 miles from the extreme points which have to be supplied with current. It contains a battery of six boilers and two units (steam engines and dynamos), each of a capacity of 100 kilo-watts; a further unit will shortly be laid down. The two units may be worked singly or in parallel. The engines are of the horizontal non-condensing type, running at 200 revolutions per minute, and driving the diphasé alternators by means of belting. A notable feature in this connection is the fact that each electrical unit comprises a twin alternator, or in reality two machines, placed one at each end of the shaft, the driving pulley carrying the engine belt being arranged in the middle of the shaft. Of course, in a case like the present, where current is employed both for lighting and for power purposes, one of the circuits may become more loaded than another, and in this event the equilibrium must be established by varying the ratio of the electro-motive forces. The arrangement adopted in the Decize installation allows of this being accomplished, as each of the two circuits having a distinct field, it is only necessary to vary the exciting current by means of rheostats to get the desired effect. The generators introduced are Zipernowsky ten-pole alternators, with revolving field magnets. The ten-field magnets are connected together in series, and the exciting current is led to them by means of two metallic rings carried on an extension of the driving shaft on the opposite side to that of the driving pulley—that is to say, on an outer extension of the shaft. Two ordinary brass brushes press upon these rings, to which the exciting current is furnished by a direct-current dynamo. This latter machine is operated by a belt from the shaft of the alternator. At 900 revolutions a minute this direct-current dynamo supplies the

exciting current for the twin alternator, being between 25 and 30 amperes at 110 volts. The fixed armature of the alternators is formed of ten coils, any one of which can be withdrawn and replaced with little trouble.

"After passing through the switch-board, the current is transmitted mainly by means of overhead wires to the points of utilization, the only portion laid underground being toward the end of the principal line leading to the Chagnats pit. The wires forming the overhead line are of silicon-bronze, and are carried on porcelain insulators attached to poles 24 ft. high. The diameter of the wires constituting the principal line to the western part of the district is 6 mm., and 4 mm. in the case of the remainder of the line. It is noteworthy that the same poles carrying the transmission wires also support telephone wires, the latter being arranged 12 ft. from the ground. In order to counteract the effects of induction in the telephone wires, the line conductors are crossed at distances averaging 540 yds., and by this means the difficulty of understanding conversation along the telephone wires which use the earth as return, has been overcome. The small portion of underground line forms a lead-covered cable, laid in a wooden conduit, as also does the telephone line for the same distance. Suitable lightning conductors are provided at the generating and distributing sub-stations and at intervals along the line. The electro-motors at the sub-stations, where the current is utilized for the different purposes mentioned in the table given above, are of the same type as the generators. These diphas motors are easily set in operation, and are to all intents and purposes left to themselves for several hours together. The only attention they receive is the visit of an employé every six or eight hours to ascertain whether the motors are working properly. The sub-stations are situated in the forest, and the facility of working on this system as compared with the erection in each place of a boiler, steam engine, and ventilating fan, is considered to be remarkable, apart from the question of the cost of transporting fuel."

The advantages of electric power both above and under ground, in point of cleanliness, compactness, ease of transmission, etc., have been so often dwelt upon that it is only surprising they have not been more often availed of by miners everywhere. The next decade will undoubtedly see a wonderful development in the application of electricity to mining operations.



RED ROCK, GOLER, AND SUMMIT MINING DISTRICTS, IN  
KERN COUNTY.

By HAROLD W. FAIRBANKS.

These districts lie in the Mojave Desert, in the northeastern corner of Kern County. At the time of the Bureau's examination they had been known for a little over a year. The placer deposits found in them lie along a line of hills or mountains which extend away from the Sierra Nevada at a small angle, beginning some miles east of Tehachapi and keeping a more easterly course than the main Sierra. These mountains are cut through in places by washes or gulches emptying southward into the sink of Desert Springs Valley. Mainly confined to the north side of this line of hills is a series of beds of conglomerate, sandstone, volcanic tufas, and lava-flows, dipping away from the range at an angle of  $20^{\circ}$  to  $25^{\circ}$ . The conglomerates at the base are free from volcanic pebbles, but consist of many kinds of rock, some of which are foreign to the district. These are quite firmly cemented and are followed upwards by friable sandrock and volcanic beds. This is evidently a deposit on a marginal sea or lake bottom which has been elevated from the south and tilted northward. This elevation is greatest on El Paso Peak, where it is nearly 5,500 ft. Jaw Bone, Red Rock, and Goler cañons, with lesser tributary cañons emptying southward, have cut these beds to a great depth. It is in these cañons and on the hills bordering them that the most of the placer gold is found. At the Summit, the easternmost district, the sandstone covers up the underlying metamorphic bedrock, and in the shallow washes draining southward from this sandstone the gold is found.

These facts all point to an original sea beach on which the gold was collected by various means, decay of rocky strata, wash of streams, etc., and that afterwards an elevation took place, followed by erosion of the present gulches, in which the gold has concentrated from the old conglomerate and sandstone. Many modifying agencies have been at work, but this seems to have been the general history. But little evidence has yet been found to show the original source of the gold. It may have been derived in part from the line of mountains on which the conglomerates rest, for a number of small veins of gold and silver have already been found. In the vicinity of Red Rock the porphyry is much mineralized over large areas, but it is not known whether it carries gold. Perhaps the richest gulch on the north side of the range, which between Red Rock and Goler is known as El Paso, is the Bonanza, which lies about 2 miles east of Red Rock. Here, as in the other gulches, the gold is found in the wash from the basal conglomerates and lava tufas. It is found not only in the gulches, but on the slopes of the hills several hundred feet above, and in the wash from the sedimentary deposits rather than from the crystalline rocks. In fact, only traces of gold are found in those gulches which head on the south side of the range or which lie above the conglomerates and other sedimentary formations.



Black Mountain, between Goler and Red Rock, Kern County.



Summit Camp, 10 miles east of Goler, Kern County





As this sedimentary formation is followed away from the range it becomes finer and is found to carry only a trace of fine gold. The exposed gold-bearing strip is perhaps half a mile wide. The gold is coarser and more abundant in those gulches which have eroded to the base of the sedimentary series. There is no possibility that these deposits are due mainly to river action, though that may have modified them somewhat. The conglomerates appear along this line of hills, in places overlaid by lava flows, as far west as Tehachapi, and are said to carry a little gold nearly everywhere. West of Red Rock no nuggets have been found. But little float quartz is found in the gravels, although small particles are often found adhering to the gold. Hundreds of claims have been taken up in the region about Red Rock, though but few of them have been worked. Water is needed to make these camps very successful, for although a few of the gulches are very rich, many are not sufficiently so to pay for using a "dry washer." There are said to be hundreds of acres which it would pay to sluice if water in sufficient quantity could be obtained.

The next gulch east of Red Rock is the Last Chance, which heads in El Paso Peak and opens southwesterly across the range. Gold is found sparingly distributed over much country along this gulch, and is more difficult to obtain, owing to the great depth of the wash in many places. In places in this gulch and its tributaries the gold is found on a sandstone bedrock, and in others in different layers in the gravels. Claims have been located for several miles, but owing to the scarcity of water but little is being done. On the east of El Paso Peak head the western branches of the big cañon which crosses the range at Goler. Colorado Camp is situated on one of these gulches. The mountains at this point consist of slate, quartzite, and jaspery rocks, much reddened by the presence of decaying iron sulphurets. In the clays and sandstones which rest against these rocks, and which are brilliantly colored, gold is found in paying quantities. It is also to be found on the decomposed hillside above.

Near the mill site of the Pomona Company prospects of coal have been found in the sedimentary series which here consists of shale, sandstone, and some conglomerate. The past winter a shaft was sunk over 100 ft., but no extensive body found. The seam, as exposed near the surface, has a thickness of 14 in., and dips north in a direction similar to the other portions of the sedimentary series. The bed is, however, at this point purely local, as it is surrounded on all sides by the metamorphic rocks. If the miners who spent several months of work here had had any knowledge of geology they would have known better than to expect a paying seam in such a position. This formation, judging from the fossil leaves found, as well as the condition of the coal, is not older than the Miocene-Tertiary. Prospects of coal have been reported in this same formation a mile or more to the north.

The Goler camps are situated at a depression of the range where a big cañon cuts through it, draining the sedimentary formations farther north. The Benson and Reed gulches, which were first discovered and in which the big nuggets have been found, empty into the big cañon at its junction with the desert plains. These gulches are filled with volcanic and other boulders, but do not head across the range. In Reed Gulch the \$1,000 nugget was found. Just north of these rich gulches there are others much deeper and which empty into the big cañon. In these the bedrock out-

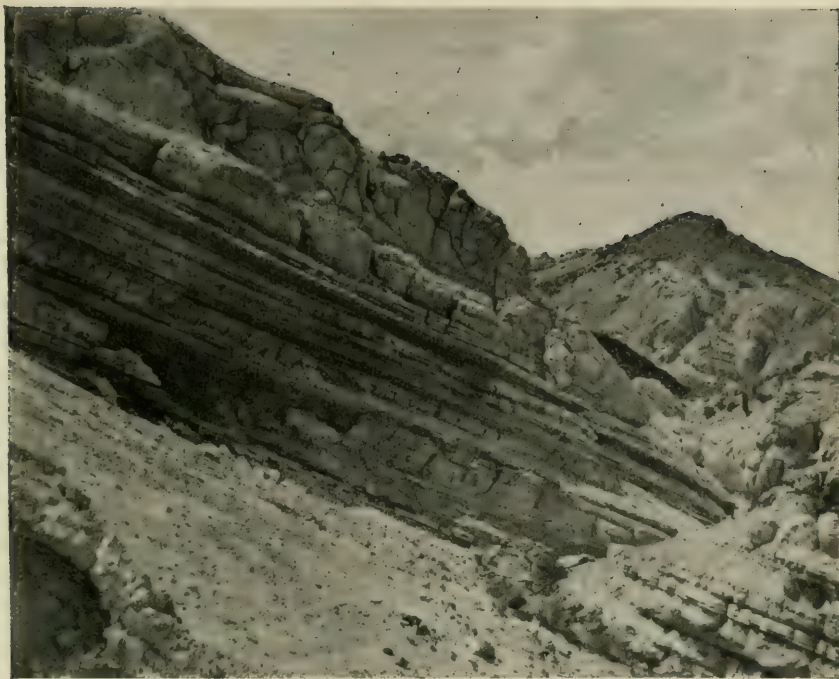
crops in places; in others on the very irregular surface of the bedrock there is a thickness of nearly 100 ft. of a cemented boulder conglomerate, many of the granite boulders being 4 to 6 ft. in diameter. In the latter gulches the pay is also fairly good. The gold appears to be present as a concentration from the conglomerate.

At the Upper Goler camp, 2 miles above the lower, mining is also carried on along the slope of the mountains on which the sedimentary formations rest. Many shafts have been sunk in Benson Gulch and in the others adjoining. In the former gulch the gold is the coarsest, there being many \$10 to \$50 nuggets. No quartz veins are found in the porphyry and slate in the vicinity of these gulches, and the source of the gold is quite problematical. The presence of the gold distributed sparingly in the conglomerates and more abundant in the gulches cutting them would indicate its derivation from the conglomerate. Strong currents must have been necessary to transport the huge granite boulders so abundant at this point, but there are no definite traces of a river channel.

Summit Camp lies 8 miles E. of Goler. At the former point the sandstone caps the ridge (the eastern prolongation of the El Paso range), and is in turn nearly hidden by the more recent wash. The shallow gulches which head in this ridge generally carry gold though not always in workable quantities. It is said that prospects of gold can be found over much of the surface. This is the highest of the camps, having an elevation of 3,300 ft. Water has to be hauled many miles. Although hundreds of claims have been located, only a few are being worked, and those not always successfully.

The same formation appears in places for some miles east of the Summit Camp, but not much gold has been found.

Dry washers are used exclusively in these districts, but there are comparatively few places where the gold is abundant enough to make that method pay. If water can be introduced there is without doubt a great future for the districts.



Stratified Volcanic Tufa, east of Red Rock, Kern County.



Sandstone Cliffs, near Red Rock, Kern County.





## AURIFEROUS CONGLOMERATE IN CALIFORNIA.

By R. L. DUNN, M.E.

Three distinct classes of gold-bearing deposits, geologically considered, have been well known and mined in California. These are, first, the auriferous quartz veins, and most naturally classifying with them, the slates and other metamorphic rocks containing gold associated with pyritous minerals. These deposits are the primary matrix and original source of the gold found in the second and third classes. The second class is that of the Neocene (Pliocene and Miocene) river gravels, auriferous from the erosion of the gold-bearing quartz veins and auriferous metamorphic rocks of the first class. These gravels are found in the channels of the Neocene rivers which became obliterated and destroyed as drainage conduits in the latter part of the Tertiary period by the lava-flows and accompanying geological phenomena of that time. They are frequently referred to as the "buried rivers" or as the "ancient rivers" of California, and they constitute the hydraulic and drift mines, the principal source of the yield of placer gold at the present time. The third class comprises the placer deposits of the Quaternary and the recent erosion and formation of the beds, bars, and benches of existing stream channels, and generally speaking, the shallow surface placers. The source of the gold of this last class is in either or both of the preceding. Though some of these latest placer deposits are locally of some importance considered as a class with regard to the total gold yield of the State annually, they are now of little and diminishing consequence.

In the summer of 1892 the writer, reporting on the mines and mineral resources of Siskiyou County for the State Mineralogist, made a superficial examination of an auriferous deposit which appeared to have peculiarities that suggested the possibility of its being unique. (See our XIth Report, pp. 420, 448.) During the past summer, 1893, under the direction of the State Mineralogist, he has made a much more detailed examination and topographical survey of the deposit. Briefly stated, this later investigation established the surmised unique character of the deposit, though some of the qualified conclusions of the preceding examination were not verified. Considered with reference to the preceding classification of the California gold-bearing deposits, its place is between the class of the lodes and that of the Neocene gravels. Like the latter it is a gravel-filled stream channel, the accumulations of erosion; like the former it is a rock in place bearing gold. Its auriferous character has clearly resulted from the action of mechanical forces in the breaking out and re-concentration of the gold of older formations, as distinguished from the action of chemical forces in the distribution of gold in quartz, and associated with the pyritous minerals in the metamorphic rocks. Comprehensively, it is an auriferous gravel bed compacted by age and some metamorphism into a conglomerate. This conglomerated condition exists occasionally in the Neocene gravels, but is not charac-

teristic of them; when it does occur being more often the result of a cementing of the mass by the chemical changes of some of its constituents than a blending and coherence as a result of pressure and age. The distinctive and unique difference is, however, age rather than physical condition. It is a much older deposit than the auriferous Neocene gravels, being a Mesozoic formation—secondary in geological age as compared with the Neocene, which is Tertiary. In the order of the succession of the rocks it rests unconformably in an eroded depression in the metamorphic Mesozoic or Pre-Mesozoic rocks. It is directly overlaid by another Mesozoic formation, the Cretaceous (Chico) sandstone. In the writer's opinion the difference of geological age seems sufficient to support a distinctive name, as it is to be presumed that other deposits will be discovered, or identified among those already known. Requiring practically the same methods of mining and treatment to obtain the contained gold as the South African Transvaal conglomerate deposits, the name "Auriferous Conglomerate" is suggested. For the purpose of description the deposit will be so referred to in this paper.

The map accompanying it is compiled from the writer's special surveys of the deposit, the U. S. Public Land Survey, and the topographical sheet of the U. S. Geological Survey. As to the general details of the locality, it is self-explanatory.

#### GEOLOGICAL.

The richness in gold of the "Auriferous Conglomerates" where exposed by the Quaternary and recent erosion, gives to the geological conditions of its existence unusual interest, both as being in a measure determinative of the probable location and gold-bearing value of the vastly greater extent of the deposit buried, and as suggesting and directing exploration for similar deposits elsewhere in the State. Accentuating this specially local scientific interest and economic importance, is the fact that there are many geological phenomena connected with this deposit that associate it with the so-called "Reef" gold-bearing deposits of the Witwatersrand, near Johannesburg, in the Transvaal, South Africa.

There are in Northern California two distinct groups of rocks, or preferably stated the rocks of Northern California are divisible into two distinct groups. These are, first, the highly metamorphic and altered sedimentary, crystalline, and eruptive rocks; and second, the occasionally metamorphic, but ordinarily unaltered sedimentary and eruptive rocks and unconsolidated formations. The first described group comprise the older formations, and compose the mass of both the Sierra Nevada and Coast Range, and the floor on which rest the formations of the second group in the region between the ranges. The auriferous quartz veins and pyritic rocks all belong to the first group, and the placers are part of the second. The first group is indifferently designated as the "Metamorphic Series" or the "Auriferous Series," but there is no distinctive group name for the second group. Stratigraphically, the Metamorphic Series includes, doubtfully, some Archæan rocks, definitely the Carboniferous and probably other Palæozoic formations, and the Mesozoic, Triassic, and Jurassic. The other group includes the later Cretaceous of the Mesozoic period, the Tertiary, Pliocene, and Miocene (Neocene), Quaternary, and recent formations. In the orderly stratification of the rocks there is a clearly marked break between the two groups. The rocks and formations of the second group rest uncon-



formably on the Metamorphic Series at every point at which their contact has been observed and examined. This unconformability is conclusive geological evidence of a period of regional elevation above the sea subsequent to the formation under the sea of the older group of rocks and prior to the formation of the rocks of the younger group; also under the sea except as to the eruptives which may be deposited either on the land surface or under water, and further excepting the noted "Auriferous Conglomerate." The formation of this latter in place is, in the writer's opinion, assignable to the period of regional elevation, while the dynamical conditions that consolidated it into its present form existed during the subsequent period of regional subsidence below the sea when the Cretaceous strata were being formed. A period of regional elevation as a period of sub-aërial erosion, during which air, rain, and running water break up and carry back into the sea enormous quantities of the uplifted rock-masses to ultimately form of them other rocks. These eroding activities of air and water are observable and measurable at the present time everywhere on the land surface of the earth. Their energy in the Tertiary period is shown in the eroded river-channel depressions and their gravel-filled beds so extensively exposed by drift and hydraulic mining in the Sierra Nevada Mountains. The Siskiyou County deposit of "Auriferous Conglomerate" is the existing result of the action of the same forces in the early Cretaceous, the deposit certainly being the gravel-filled channel of a Mesozoic river. This, although its position under the Cretaceous (Chico) sandstone, adjacent to the shore-line of the Cretaceous sea, quite naturally has suggested that it might be a sea-beach-formed conglomerate and not accumulated river gravels in place. Such sea-beach or near-shore conglomerate deposits would be formed by the direct wave erosion of the solid rocks; by tidal and current distribution of originally river gravels which have been discharged by torrential streams into the sea at their mouths; and third, by the erosion and redistribution of the channel accumulations of submerged rivers, such a phenomenon, for example, as is now presented at Gold Bluffs on the coast of Northern California. The rocks of the Metamorphic Series on which the "Auriferous Conglomerate" rests unconformably form the northern portion of the main auriferous mineralized belt of Siskiyou County (see our XIth Report, p. 421), and are markedly auriferous in the immediate locality of the conglomerate. Gold-bearing quartz veins are numerous, and the rocks themselves are highly quartzose and mineralized with pyritic minerals. Still there are no workable veins known; only small seams and occasionally a rich pocket. The recent placers exclusively formed from their recent erosion are insignificant in extent, and have never been profitably mined. The wave erosion of these hard rocks, limited as such erosion would be to the cutting edge of the wave crest, and by the protection against even that cutting afforded by the accumulation of eroded fragments, cannot account for the enormous mass of the conglomerate. The linear extent of the latter is certainly 10 miles, possibly more than double that additional, its width where measurable about 1,500 ft., and thickness an average of 100 ft. The rocks are not sufficiently auriferous for their direct erosion to account for the relatively much greater auriferous value of the conglomerate, nor can wave energy account for the concentration of the gold at the bottom on and near the bedrock. The preceding stated conditions are equally conclusive against the possibility of the formation of the deposit by tidal and current dis-

tribution of the discharged gravels of torrential streams. In addition, the topography of the section is such that the inference is against the existence of any such streams. It is, however, possible that the regional subsidence preceding the formation of the overlying Cretaceous sandstones for a period brought within the range of action of the sea waves the gravel-filled river channel. It is possible that some erosion of the upper portion of the original mass took place, but it is evident that the erosion did not extend to the bed of the old river and that the conglomerate is in fact the river gravels in place so far as sea erosion is concerned. A condition of regional subsidence in which the rate of sinking exceeded the rate of the erosion by the rising wave edge, explains the preservation in place of the old channel gravels. Precisely this phenomenon is presented by Gold Bluffs. There the ocean is cutting into the gravel- and sand-filled channel of the ancient Klamath River. But the drift accumulations now being cut away must have been made above the sea-level, necessarily inland, and probably during a period of local uplifting, which ultimately, by its obstruction to drainage, diverted the river into its present channel. As a consequence of subsequent regional subsidence (continuing down to the present time, if indeed it is not now going on), this ancient river channel is disappearing beneath the sea at a rate which has prevented its complete obliteration by wave erosion. The latter is only cutting away and redistributing the upper portions of the old debris-filled channel. The bed, and likely several hundred feet depth of sands and gravels, are sinking beneath the sea surface undisturbed by its waves.

The fluviatile origin of the conglomerate deposit is further established by its appearance in sections afforded by the existing stream cuts and by mining excavation. On the map is shown a cross-section of the "Auriferous Conglomerate" and associate formations made by the Klamath River. It distinctly shows the bedrock bottom and limiting rims of the old channel. The Tertiary and Quaternary uplift (probably the latter, as the tilting seems to extend to the capping Tertiary lava) has tilted the Cretaceous beds so that though originally deposited approximately level they now have a mean dip of  $17^{\circ}$ , in direction about N.  $55^{\circ}$  E. Restoring the section by eliminating the dip of  $17^{\circ}$ , the bedrock under the middle of the deposit of conglomerate becomes level for a distance, as determined, of about 800 ft. This would then be the width of the bed of the old channel at this particular point. The southwest rim, in the section as existing rising with  $24^{\circ}$  of slope from level, in the restored section rises with only  $7^{\circ}$  of slope from the bed of the old river. The northeast rim, in the existing section appearing nearly level, in the restored section rises with  $17^{\circ}$  of slope from the bed of the old river channel. This northeast rim limits the downward extension of the "Auriferous Conglomerate." Farther to the northeast the sandstone rests directly on the metamorphic rocks, the contact disappearing under the Klamath River. Correspondingly the upward extent of the conglomerate is limited to the southwest rim. Beyond it the sandstone rests directly on the metamorphic rocks. Not shown on the Klamath section, this appears in plan on the main map.

The tributaries of Cottonwood Creek do not cut through the conglomerate, but the partial sections made by their erosion show the distinctive individual slopes of southwest rim and channel bed.

The principal section afforded by mining excavation is the bank face

in the hydraulic pit of the Blue Gravel Mine on the right bank of Klamath River. Its appearance is similar to the sectional exposures of gravel banks in the hydraulic mines in the Neocene river deposits. As far down as the action of the atmosphere and surface water extended the color of the deposit is red, and it is more or less decomposed. The balance of the deposit is dark blue in color, suggesting the name "blue gravel." The conglomerate is composed of water-worn rounded pebbles, cobbles, and large boulders, derived from the metamorphic and crystalline rocks, quartz, granite porphyry, limestone, and diabase, the latter the immediately underlying bedrock. The cementing material consists of sands and clays, the finer fragments and sediments of the same rocks. Streaks and beds of sandstone and a soft red rock appear in the body of the conglomerate, corresponding to the sand and pipe-clay streaks of the Neocene gravels. Other constituent parts of the conglomerate in small quantities are gold, magnetite, hematite, pyrite, chalcopyrite(?), garnet, ruby, and sapphire, all (except the gold and hematite) in small water-worn grains. Some of the hematite appears in pseudomorph crystals apparently after calcite. The gold is generally of the description known as channel gold, occurring in nuggets, coarse and fine grains, scales, and flour gold. Its distribution is similar to the observed distribution of the gold in the gravels of the Neocene and existing streams. It is largely concentrated near the bedrock, on and even in it, in pay streaks or leads. These seem to follow the longitudinal direction of the channel.

The irregular, meandering line of the old channel adjacent to Klamath River is displaced by the tilting of its plane, and subsequent erosion has left it in relief, so far as some of the adjacent region is relatively situated. The continuity of the conglomerate deposit is inferable through this section from the exposures which are numerous and not widely separated. Its location is determinable with a fair approximation to accuracy from these same erosion exposures. Northward from the Klamath a distance of 5 miles, it is so located and delineated on the map. Southward 7 miles it is indicated, but with a less degree of exactness toward the southern end, as the conglomerate exposures are less conclusive. Both northward and southward from the determined section the displacement has left the old channel deeply buried. Excepting an exposure of the conglomerate for a distance of about a mile near Yreka, there is no surface indication from which the buried portion of the old channel can be located.

The data on which is based the conclusion of the writer, that the conglomerate is an old river channel deposit, has been here presented in considerable detail by reason of its particular pertinence to the occurrence of the gold. If the conglomerate were a beach deposit formed from direct erosion, its gold-bearing character would be limited and local to points adjacent to where auriferous quartz veins were cut down and broken up, and there could be no presumption of gold-bearing value as an incident of the linear extent of the deposit. On the other hand, the certainty that the conglomerate is an old river bed accumulation in place, establishes a presumption of average gold content per unit of weight, volume, or bedrock area, for the buried and uneroded portion of the conglomerate, equal to the average gold content per corresponding unit of the naturally eroded or mined portion; that is, the



conditions of gold distribution and gold content per unit are precisely those of the Neocene river gravels, and may be similarly estimated.

The direction of the flow of the old river was most probably southward, the writer's opinion being based on its location with reference to the Coast and Sierra Nevada ranges, and on the assumption of the Mesozoic regional elevation during which the river existed, being the resultant of geological activities, the recurrence of which has produced the present relief of the region. Also cumulative of this, the exposed area of the rocks of the Metamorphic Series adjacent to the conglomerate does not seem sufficiently extended and auriferous to account for the gold accumulation in the conglomerate. Yet it is from this area that all the gold must have come if the flow of the old river was northward. There is no other possible source for it on the assumption of a northward flow. With a southerly flow, however, the old river had the erosion of the indefinite northward extent of the main mineralized belt of Northern California, which is now buried underneath the Cretaceous and later formations, from which to concentrate gold.

The geological phenomena that associate this California "Auriferous Conglomerate" with the so-called "Reef" (conglomerate) deposits of the Witwatersrand, Transvaal, in South Africa, are particularly connected with the overlying Cretaceous strata, and not with the conglomerate itself. These strata consist of sandstones mainly, but stratified conformably in their mass are shales (locally termed "mud slates") and seams of conglomerate similar in composition and appearance to the main underlying bed. The shales are also associated with a greater or less development of lignite in seams and beds; at one point, designated on the map, three miles southwest of Ager, a vein 3 ft. thick is being mined. Excepting the lignite, the structural formation of the "Reef" deposits is identical. The South African formation is, however, much the older, being carboniferous, and metamorphism has altered the sandstone into quartzite, the shale into a schist, and has tilted and faulted the strata. The conglomerate is identical in appearance with the South African. No examination has been made to determine if they are equally auriferous. It is suggested that a more thorough study of the Siskiyou County formation and the phenomena presented at Gold Bluffs may tend to solve the problem of the occurrence of the gold in the South African conglomerate.

#### TOPOGRAPHICAL.

The drainage of the region of the "Auriferous Conglomerate" is through Klamath River and some of its tributaries. The surface of the country west of the deposit is broken and mountainous. North of Klamath River, Cottonwood Creek has made two narrow valleys, the lower one just east of the deposit. South of Klamath River the middle drainage basins of Shasta River and Willow Creek merge into each other and together form Shasta Valley. Between the valley and the river is Black Butte, a lava-capped mountain 5,270 ft. high. The conglomerate deposit is close to the western rim of Shasta Valley, as far as traced, and it passes beneath the southern and western edges of Black Butte. The mean elevation of Cottonwood Valley is 2,200 ft., and of the portion of Shasta Valley adjacent to the conglomerate deposit about 2,700 ft. The

latter, north of Klamath River, is between 2,100 and 2,800 ft., and south of it between 2,100 and 3,500 ft. in altitude.

The Klamath River in this locality is a large torrential stream. Flowing southwesterly it crosses the contact of the Metamorphic Series and the Cretaceous sandstone nearly at right angles. The section across the conglomerate has already been described. Longitudinal exposures of the conglomerate have been made on both sides of the river by small tributaries. On the northern side Rancheria Gulch is a small depression, scarcely a mile in length. Its bed follows closely the existing line of contact of the formations, and to its erosion is clearly due the existing adjacent portion of this contact line. Adjacent to the river it has eroded its channel diagonally across the old river channel bed, cutting away and carrying off into the Klamath River a considerable area of the conglomerate. Its particular interest is in its shallow placers, which, though limited in area, were extremely rich, and unquestionably derived their gold from the erosion of the conglomerate. On the south side of the river Carson Gulch has exposed the edge of the conglomerate deposit for a considerable distance, but apparently has not cut as deeply into it as Rancheria Gulch. The gold of its placers seems to have come almost entirely from the erosion of small auriferous quartz ledges in the hard metamorphic rocks. These placers were noticeably not as rich as those of Rancheria Gulch.

The lower Cottonwood Valley is the most interesting topographical feature of the district. Cottonwood Creek, flowing through it, is a large stream which rises in the Siskiyou Mountains in Oregon, and with numerous small tributaries drains a large area of country lying partly in both States. The valley is clearly the result of the erosion of the creek in the comparatively soft sandstones and shales lying between the hard metamorphic rocks and the equally hard lava. More particularly, it is the cumulative effect of a number of channels successively eroded by the same stream at different periods in its history, the process of its action being that described in our XIth Report (Siskiyou County) as the cause of bar and bench formations on the Klamath River, namely, the greater rate of channel-bed cutting of a running stream in soft rocks as compared with hard rocks. The first drainage channel of Cottonwood Creek probably formed on the contact of the lava and the metamorphic rocks subsequent to the Quaternary tilting, and ultimately cut below the lava into the softer sandstones and shales. In these the rate of cutting was much more rapid than that of the Klamath River in the hard metamorphic rocks below the junction of the two streams, until a base level determined by the Klamath erosion was approximated. The creek then losing its carrying power through diminished velocity of flow, ceased cutting and commenced accumulating sands and gravels, raising the bed of the water flow until the obstruction to drainage diverted it into a new line of depression, to be by it eroded into a second channel. In turn the second channel, and successive channels subsequently, went through the same process of formation and obliteration, each working its cut a little deeper than the immediately preceding one, and a little farther to the northeast—the greater depth to bring it to the new base level of the Klamath determined by its erosion between the periods of two successive channel formations, and the northeastward tendency caused by the relatively larger quantities of debris brought in by the tributaries from the southwest, which, accumulating, maintained that side

of the channel higher than the other, which then became the depression for the water flow and erosion. Extensive remains of the detrital accumulations of one of the first of these channels, if not indeed the first, exist in a range of low hills lying on the base of the mountains on the southwestern edge of the valley. They are composed of clean-washed and water-worn gravels and cobbles, and a soft, sandy clay. The rock is so largely quartz that the deposit is locally known as the crystalline wash. Between the remains of this old channel and the present channel of the creek, there are the fragmentary eroded depressions and drift accumulations of the several channels of the intervening period, and also the remains of one or more old channels of each of the tributaries, the latter making cross erosions. All of these channels are merged and obliterated more or less, one by the other, and by the present channels of the tributaries, so as to be indeterminate as to individuality. It is, however, their cumulative effects which are significant and most appreciable, namely, the formation of the valley, and the accumulation and concentration in it in shallow placers of an enormous quantity of gold.

#### ECONOMICAL.

In 1852 the shallow placers of the Cottonwood Valley were discovered. Limited in extent to a district not over 3 miles long by  $1\frac{1}{2}$  wide, they have yielded in the forty-two years elapsing since the date of their discovery an immense amount of gold. Nearly all of the mining was done in the "fifties" by individual miners or small companies, using only the simplest appliances—pan, rocker, and sluice. Anything more than an approximate to the aggregate value of the gold taken out since their discovery can never be known. The best informed of the old residents estimate that \$4,000,000 has been taken out, including in this the yield of Rancheria Gulch. The basis of their estimate is the number of miners engaged in the several years, and the daily gold yield to each miner. The town of Cottonwood, now Henley, built and supported entirely by these mines, at one time in the early "fifties" had a voting population of 700, and a Chinese population of 500. In 1854 one of the storekeepers is said to have sent a mule load of gold every week to Yreka, the supply point for the district. One of the claims, the Brass Wire, in Rocky Gulch, is known to have yielded over \$250,000. As a whole the placers were considered rich, even for early days, and quite generally are said to have paid miners more than the then ruling rate of day wages. Confirming this reputed richness, the occasional discovery and working of small areas overlooked by the old miners or covered by their tailings piles, pays the miners from \$6 to \$20 a day.

Almost exclusively all of the mining has been in the fragmental remains of the old channels lying in the valley between the channel known as the crystalline wash and the present channel, and in the channels of several of the tributaries. No gold has been found in the crystalline wash, and the present bed of the creek was not especially productive. Rancheria Gulch contained a small area of exceedingly rich placers, and became the site of a small mining hamlet for several years. The largest nugget found in the district came from these placers. It was valued at \$1,900.

The situation of Rancheria Gulch with reference to the "Auriferous Conglomerate," the absence of quartz veins within its drainage area



sufficiently numerous and rich to have been the source of the gold found in its placers, the identity of the gold found in the placers with gold found since in the adjacent conglomerate, are conclusive in establishing the "Auriferous Conglomerate" as the source of the gold of the shallow placers to which reference has been made. As a physical necessity resulting from the occurrence of the gold in Cottonwood Valley in placers demonstrably formed by existing streams, the source of the gold, so far as those placers determine it, is within the drainage area of Cottonwood Creek as it now exists. East of Cottonwood Creek no trace of gold has ever been found. West of it, above what is designated on the map as "Cañon," being the channel of the creek in the hard metamorphic rocks, only the deposits at Soda Bar and in the West Branch contained any gold. These placers are limited in extent and have never been particularly rich. The source of their gold is clearly determinable as being in the small quartz veins in the upper portions of the drainage area of the West Branch. The tributaries of Cottonwood Creek, Kanaka Gulch (now discharging directly into the Klamath, but at an earlier period in its history into the creek), Rocky Gulch, Rancheria Creek, and Ditch Creek, all contained placer deposits and all have been mined. From the placers in the main valley up to where the "Auriferous Conglomerate" is cut through, these placers have been uniformly rich. Above the conglomerate, except in Rocky Gulch, they cannot be mined profitably, and are very limited in extent. Noticeably the gold obtained from them is different in description and fineness from the gold of the lower placers. It is, as a rule, little washed, and undoubtedly derived directly from the small auriferous quartz veins of the metamorphic rocks. The auriferous character of the conglomerate, determined directly from mining it, makes conclusive the evidence establishing it to be the immediate source of the gold of the Cottonwood Valley placers.

Klamath River, receiving the erosion of Cottonwood Creek as well as its own direct erosion, derived from the "Auriferous Conglomerate" a very large amount of gold. No gold at all is found in its bed, bench, or bar formations above the junction of Cottonwood Creek. Nugget and coarse gold has only been found in the section of the river from Cottonwood Creek downward to about Honolulu. Above this last noted place there is only one area, other than the conglomerate section, which has contributed any large amount of gold to the river. This is the drainage basin of Humbug Creek discharging into the river 2 miles above Honolulu and 15 miles below Cottonwood Creek. At Honolulu, the writer is informed, pieces of the conglomerate are found in the river mines containing gold, also coarse gold that probably came from it. Above Humbug Creek it is probable that by far the largest portion of the gold in the river bed was derived from the conglomerate. How much has been mined from this section of the river is not known. So far as known, river mining in this section has been profitable. It has been as extensively carried on as in any other portion of the river, employing as many companies and men, and as continuously. The total of yield in the forty years of its mining can be certainly estimated in the millions.

The contacts of the conglomerate and bedrock where exposed by erosion have been determined and surveyed. From them the superficial areas of erosion of the old channel bed and rims have been computed

with a fair approximation to accuracy. The figures so determined are as follows:

For Klamath River .....	3,500,000 sq. ft.
Rancheria Gulch .....	1,000,000 sq. ft.
Kanaka Gulch .....	100,000 sq. ft.
Rocky Gulch .....	200,000 sq. ft.
Rancheria Creek .....	700,000 sq. ft.
Ditch Creek .....	400,000 sq. ft.
Bushy Gulch .....	200,000 sq. ft.
Total .....	6,100,000 sq. ft.
Or excluding Klamath River, the total is .....	2,600,000 sq. ft.

This last total being the superficial area of the old channel, the erosion of which has directly contributed to the formation of the Rancheria Gulch and Cottonwood Valley placers. Considerable of the gold of this area has undoubtedly been carried into Klamath River, and another large amount is still in unworked shallow placers. The sum of these two amounts is assumed to be at least an equal offset for the gold that has been mined in these shallow placers, the source of which, could it be known, would be in the metamorphic rocks above the conglomerate. The total yield of these placers being estimated at \$4,000,000, and the area of eroded conglomerate being 2,600,000 sq. ft., the yield has been at the rate of \$1 54 per square foot for both channel bed and channel rim areas.

The Cottonwood Valley and Rancheria Gulch placers were the result of nature's hydraulic mining, or rather ground-sluicing, on an enormous scale, with time limits marked by the geological ages. Into them was concentrated gold, which in the conglomerate was distributed throughout its entire mass. There is no mining method by which it is possible to economically effect the same result; that is, to obtain by mining methods and appliances all of the gold in the conglomerate. In this the deposit is like some of the Neocene river gravels containing gold distributed throughout their entire mass, but which are either covered with too great accumulations of barren formations, or have not the necessary amount of dump for working on a large scale. Like these same Neocene gravels, the economic value of the deposit is restricted to the gold content of that portion of the mass in which it is most largely concentrated; this is the 4 or 5 ft. in depth of the conglomerate resting directly on the bedrock of the old channel bed, and including the softer superficial portions of the bedrock itself in which some of the gold is imbedded. In the Blue Gravel Mine a sufficient area of this channel bedrock has been worked for its yield to provide a safe basis for estimates of the gold content of the unbroken ground in the channel, and of the economical value of the entire deposit. This mine was discovered in 1887 by a Mr. C. B. Jillson, whose experience was obtained in the hydraulic and drift mines in the Neocene gravels in Sierra County. Prior to this discovery the auriferous character of the conglomerate does not seem to have been suspected. Proceeding on his former experience, and thus very naturally misconceiving the real character of the deposit, Mr. Jillson opened the mine and attempted to work it by hydraulicking, bringing in a supply of water from Ditch Creek for that purpose. At the date of the writer's examination 31,000 sq. ft. of the bedrock had been completely stripped, and had yielded in round numbers \$20,000, an average of 60.6 cents per square foot. It is, however, known that a large amount of gold was swept into the dump, the Klamath River, in unbroken masses of

conglomerate, and that there was a further loss of gold in sulphurets. An additional area of hydraulic stripping was done, but the bottom conglomerate left. This at the time of examination was being taken up by hand and worked in an arrastra. This working, though by no means thorough, as the conglomerate masses were not pulverized, returned a larger unit yield for the bedrock stratum than the hydraulicking did for an average depth of 20 ft. washed. The yield for 420 tons worked was \$1,489, an average of \$3 52 per ton, or 88 cents per square foot of bedrock area. With proper appliances and methods, thorough pulverization, and the concentration and working of the sulphurets, the yield would safely have been \$1 a ton, or 25 cents more per square foot. The arrastra tailings contained about 1 per cent of concentratable magnetite and pyrite, which assayed \$101 per ton.

From the slope of the Black Jack Mine 100 tons of the conglomerate were worked in a stamp mill, returning \$275, or at the rate of \$2 75 a ton. It is known that all the gold was not returned, the milling not being thorough, and much fine gold being lost in the tailings. An assay of concentrates from this mine is said to show \$590 to the ton. No determination was made of the percentage of concentrates, however.

At the Charter Oak Mine, in Ditch Creek, the tunnel had only cut through the rim into the conglomerate. Prospecting showed some fine gold and concentrates which assayed \$120 a ton.

In the writer's opinion, the development of the Blue Gravel Mine is sufficient to make its figures of unit gold-content of actual return and safe estimate of avoidable loss, a basis of estimates. These figures are: actual return, \$3 52 a ton, or 88 cents per square foot, and avoidable loss estimated \$1 a ton, or 25 cents per square foot. The total of the two is \$4 52 a ton, or \$1 13 per square foot of bedrock area. To further assure safety of the estimate of available gold content of the entire deposit, these figures are reduced to \$4 a ton, or \$1 per square foot. Assuming a channel-bed width of 800 ft., as indicated by the survey of the Klamath section, the economically available gold content of the portion of the channel that can be located north of Klamath River is \$21,000,000, and of the section south of the Klamath \$22,000,000; in all a total estimate of \$42,000,000.

In stating \$1 as the writer's estimate of economically available gold content per square foot it is not to be inferred that each and every square foot of the channel bed contains an approximation to that amount of gold. As a practical fact, large areas likely contain no gold at all, their proportion being concentrated in pay leads or areas of higher unit yield. Further, much of the gold is coarse, nuggets ranging in value from \$10 upward forming much of the total value of the deposit.

The conditions of existence of the gold necessitate drift mining as the method of exploitation of the conglomerate. For this the topography is specially favorable. Nearly the entire extent of the located channel is above the drainage level of Klamath River. The mining can be through tunnels, and the conglomerate is so compact as not to necessitate timbering the mining excavations other than may be required to facilitate working. Ventilation is possible by natural draughts. The conglomerate works well with powder. Power drills and traction can be economically used. An abundance of water power is available by electric transmission from Klamath and Shasta rivers and Cottonwood Creek. Economy of construction and maintenance of the necessary



mining and milling plants is assured by the near location of sawmills, direct railroad transportation to the centers of trade and population, and an adjacent agricultural country in Shasta Valley and Southern Oregon.

It is not to be lost sight of, however, that the deposit is distinctly a low-grade proposition. Its profitable working is only safely assured by operation on a very large scale with large plants, making every possible economy. Under the suggested favoring conditions of operation the cost of mining and milling should not exceed \$1 50 a ton, or 37½ cents per square foot of area.

Since the preceding was written the writer has had an opportunity to examine some other Cretaceous and Pre-Cretaceous auriferous placer deposits. The Chico beds, sandstones and shales, which overlie the "Auriferous Conglomerate" in Siskiyou County, extend far southward into Shasta County, in California, and far northward into Oregon. Four miles southwest of Redding, in Shasta County, the Chico sandstone is found resting unconformably on the metamorphic Pre-Cretaceous rocks precisely as it does in northern Siskiyou County. In what is locally known as Oregon Gulch, close to the contact of the sandstone and metamorphic rocks, a shaft was sunk through 40 ft. of sandstone to the metamorphic rock (slate) which dipped eastward on about the same pitch as the bedding of the sandstone. Following the contact downward on the pitch the shaft opened up a small bed of auriferous gravel lying in a depression of the slate underneath the sandstone. This gravel bed where cut was 2 ft. deep in the middle and about 40 ft. across. Singularly enough, it was neither cemented nor conglomerated, though it contained considerable amounts of oxide of iron, and must have been subjected to enormous pressure from the mass of consolidated sediments overlying it. The gravel is smooth and stream-washed, but contains marine shells too much broken to be identified. The gold is very fine, and is found in the fine pyritic matter. On a smaller scale, the deposit is a copy of the Siskiyou deposit. It probably belonged to the tributary system of the larger channel. In this connection it is noteworthy that Mr. J. S. Diller, of the U. S. Geological Survey, has found the fragmentary remains of Cretaceous stream channels a few miles still farther to the southwest of Redding.

Just across the State line in Jackson County, Oregon, is the valley of Bear Creek, a tributary of Rogue River. The contact of the sandstone and granite traced northward from the State line after crossing the summit of the Siskiyou Mountains close to the railroad tunnel, crosses the head of Bear Valley east of the railroad, then turning more northwesterly recrosses the valley just north of the town of Ashland, and thence runs through the foothills flanking the valley between Ashland and Jacksonville, and comes out into the valley again just east of Jacksonville. The valley itself between these places is eroded out of the sandstones, but the erosion at no place exposes the conglomerate seen in California at Henley. However, on the hill slopes between Ashland and Jacksonville are exposed some very much decomposed conglomerates bedded in the sandstone. Whether one bed or several of this conglomerate exist, the exploration made is not sufficient to determine, but the conglomerate wherever exposed is auriferous. In superficial appearance the conglomerate is an ocherous-looking decomposed rock. On

closer examination it is found to contain considerable quartz, a portion of it distinctly water-worn and rounded. The other prominent constituents are feldspar and mica. It is evidently the resultant of the erosion of the adjacent granite. The gold is very fine, free in large part, but blackened and coated. Associated with the gold are found magnetite, pyrite, cinnabar, natural amalgam, and free quicksilver. What is known as the Golden Fleece Mine is located on this deposit, near Ashland. A pit has been excavated in the bed and some short drifts run, following the conglomerate into the hill. The bed rises with the hill slope, but at a less angle. On the mine is a 3 ft. Huntington mill, in which several runs have been made of the conglomerate, with more or less satisfactory results. Yields of from \$1 to \$5 a ton have been obtained in free gold. The concentrates are very high grade, containing gold too much coated to amalgamate, as well as that mechanically held by the sulphurets. The methods employed, it seems to the writer, can be considerably improved. Mining and crushing can be done very economically, but more effective appliances are needed for obtaining the gold that does not amalgamate either in the battery or on the plates.

The occurrence of gold in sufficient quantity in this Ashland conglomerate to admit of its economical extraction is suggestive of similar possibilities in conglomerates bedded with the sandstones and shales in the vicinity of Henley, in Siskiyou County. The Cretaceous sandstones that overlie the auriferous conglomerate, the old river channel deposit, in addition to beds of shale and occasional seams of coal, contain several conglomerate beds exposed by the ravine erosions. These have never been mined nor tested to ascertain whether or not they contain gold. Their exploration is, however, expedient under existing conditions of our knowledge of gold-bearing deposits.

In conclusion, the writer desires to express his obligations to Professors Joseph LeConte, Christy, and Lawson, of the University of California; Prof. Brander, of the Leland Stanford Jr. University; Mr. Jas. E. Mills, Mr. Waldemar Lindgren, Mr. Ross E. Browne, and Mr. J. S. Diller, for assistance and friendly criticism given him during the preparation of this paper.

PRELIMINARY REPORT ON THE MINERAL DEPOSITS OF  
INYO, MONO, AND ALPINE COUNTIES.

By HAROLD W. FAIRBANKS.

*Introduction.*—That portion of California lying east of the Sierra Nevada Mountains, and extending from northern San Bernardino County to Alpine County, was examined by the writer, assisted by Mr. R. P. Heagan, during the season of 1894. The trip occupied the months of April, May, June, and July, but owing to the great extent of country, and the exceedingly barren and rugged nature of portions of it, little more than a reconnoissance report on the mineral deposits can be made, with the exposition of some general principles of the structure of the country. It was found that in order to gain an understanding of the character and value of the mineral deposits a much more thorough geological examination would have to be made.

*Topography.*—The whole of the region examined lies within the Great Basin area, and in many respects, in regard to climate and physical features, as well as in its mineral deposits, it is much more like Nevada than California. On the west, the Sierra Nevada, with its almost precipitous scarp, rises 6,000 to 9,000 ft. from the valleys at its base. As we go eastward the region is seen to be traversed by a series of northwest and southeast ranges, in a general way parallel with the Sierra Nevada; and between these a series of desert valleys, becoming lower toward the east. Salt Wells and Owens valleys lie on the west directly at the base of the Sierra. The former has an elevation of about 3,000 ft., the latter an average elevation of a little over 4,000 ft. East of the Argus range is Panamint Valley, portions of which are not over 1,200 ft. above sea-level, while between the Panamint and Amaragosa ranges is Death Valley, below the sea-level. The U. S. Geological Survey has determined that one point in Death Valley is 480 ft. below the level of the sea—the greatest natural depression in the United States. The Inyo and White Mountain ranges rise to an elevation of 9,000 to 13,000 ft., while the Panamint reaches 10,000 ft. The larger valleys have all been occupied at some very remote period by alkali lakes, of which Owens and Mono lakes are the only ones of any size still remaining. As the valleys decrease in elevation to the south and east they become more arid, and finally blend into the great stretches of the Mojave Desert. Salt Wells Valley, lying mostly in northern Kern County, has the greatest extent from east to west, nearly 20 miles in places. It is separated from Owens Valley by an elevation so slight that it is proposed to introduce a great irrigating ditch from Owens River. This ditch commences 12 miles above Independence, some miles being partly constructed. The survey carries it around the west side of Owens Lake, and through the pass at Little Lake to Indian Wells. The length of the ditch is to be 110 miles; with a width of 35 ft. at the bottom and a depth of 6 ft. It is being built by the California Waterworks and





Death Valley from the Panamint Range.



Pack Train in Panamint Valley.



Irrigation Company, of London. Owens Valley has a length of fully 75 miles, and a width in places of 10 miles. It contains the largest part of the agricultural population of this part of California.

*Geology.*—The most important geological reports on this region have been upon the quaternary Lake Mono, by Israel Russel; on the general geology of Inyo and Mono counties, by W. A. Goodyear and others of the old State Geological Survey.

Save for the presence of lacustrine beds of late Tertiary or Quaternary age, and recent lava-flows, the younger geological formations are wholly absent from the eastern side of the Sierra. The eastern side of this range in Inyo County is formed wholly of granite; in Mono County there are large areas of metamorphic rocks.

The numerous ranges to the east might be described in a general way as consisting of an immense thickness of limestone, quartzite, slate, mica schist, etc.; the whole intruded by granite and raised in immense anticlinal or monoclinal folds. The granite areas are not confined to the axes of the ranges, but occur in the most irregular manner.

A brief description of the different ranges will be given, commencing in southern Inyo County. The Argus range begins on the southern border of the county as a low range of granite. Northwest of Borax Lake the mountains become much more prominent, and appear to consist wholly of granite as far as Shepard's Cañon. A little north of this point the granite passes to the west, forming the Coso range, which extends north to Owens Lake. A little north of Snow's Cañon, along the road to the Modock Mines from Darwin, limestone, slate, and quartzite are seen to have almost replaced the granite in the Argus range. North of Darwin this range again sinks, finally blending into the Inyo range. The Panamint range extends for a distance of 60 or more miles, and is in its higher portion the most prominent landmark of the desert. Limestone, quartzite, slate, and mica schist form the predominating rocks. Areas of granite are, however, found in places. Toward the north a spur of this range, known as the Pinto or Calico range, connects with the Inyo range. In the former range there is exposed a great thickness of beautifully variegated and banded limestones facing the west and visible for a long distance. Near Cerro Gordo but little granite appears in the Inyo range, and that is confined to the eastern slope. Farther north, in the Beveridge District, there are large bodies of granite uplifting the limestone in the center of the range and throwing it back in folds on the slopes. The granite forms the central portion of the range for a number of miles. Areas of this rock of considerable size appear in places in the White Mountain range, farther north.

Volcanic flows are very numerous over much of the western part of Inyo County. They consist mostly of basalt, and are very similar in appearance. Volcanic action seems to have been most severe in the Coso Mountains. The flows are not apparently all of one age. North of Owens Valley, between Bishop Creek and Mono Lake, there are extensive areas of volcanic tufas of various kinds, hornblende andesite predominating. These reach the summit of the Sierra Nevada between the heads of Kern and Owens rivers. The region about Mono Lake has been the scene of recent flows of basic as well as acidic lavas. North of the lake there is a great area of hornblende andesite, extending with local interruptions north to the summit of the Sierra, in Alpine County, and for an unknown distance into Nevada. The andesitic flows evidently took place prior to



the last great uplift of the Sierra Nevada. The region east of this range has been subject to many and violent disturbances, accompanied by lava-flows, some so long ago that profound modifications of the surface have since taken place, others so recent as to have undergone but slight erosion.

*Mineral Deposits.*—The following minerals are known to occur in the region under discussion: Gold, silver, lead, antimony, copper, iron, soda, and borax; besides excellent marble, travertine, and granite. Of these the most important are gold and silver. The silver output has in years past been the largest in Inyo County, while Mono County is more particularly characterized by gold. No statement of general application can be made as to the distribution of gold and silver or to the relation of either to any particular formation. It seems, however, that the silver-lead deposits are generally found in the limestone, which covers so much of this region, and the gold less often. There are notable exceptions to this rule, as at Benton, Mono County, and in the White Mountain and Panamint ranges.

A brief description of the different mineral deposits will be given, beginning with gold.

The Argus district, in the southern portion of Inyo County, embraces a granite region. The quartz veins which are being opened here contain silver and gold in varying proportions; the gold is, however, generally in excess. So little work has been done that the extent and value of the ledges have not yet been demonstrated. The gold is found free on the surface, but from the honeycombed character of the quartz, and the occasional presence of chalcopyrite and iron pyrites it is believed that at no great depth the most of the gold is contained in them. The silver is contained partly in copper glance, little or no lead ores occurring. The veins have no regularity of position, nor do they bear any relation to the numerous porphyry dikes intersecting the granite of this region.

Farther north, in Mountain Spring Cañon, there are small veins of gold-bearing quartz in a granitic rock, the gold being partly free milling and partly contained in iron pyrites.

On the eastern side of the Argus range, a little south of Shepard's Cañon, small silver deposits begin to appear, and are traced northward toward Modock and Darwin. In Snow's Cañon, near the northern termination of the granite of the Argus range, occurs a group of quartz veins, which, though generally small, are quite rich in gold, and also have a small content of silver. The richest portions of the quartz are much honeycombed, a character evidently resulting from the decay of pyrites. Those veins nearer the limestone contact are richer in silver.

The next deposits of gold northward are found in the Coso range, southwest and west of Darwin. The country rock is a coarse, easily decomposed granite. The veins have been worked to a depth of several hundred feet and are said to maintain their strength, but work was finally abandoned, because with greater depth more of the gold was found to be contained in iron and copper pyrites, and with the crude means at disposal could not be profitably worked.

The Panamint range is characterized chiefly by silver deposits. There are, however, some of gold in the southern portion. Near Post Office Cañon several veins of quartz are found, rich in gold (free milling on the surface) and inclosed in limestone. Ten miles south other deposits

have been discovered, but no development work of any consequence has yet been done.

About Cerro Gordo no ores but those of silver and lead are found. A few miles north, in the Beveridge District, on the eastern slope, where the limestone has been shoved aside and uplifted by a great granite mass, are found many gold-bearing quartz veins. In the most southern mines of this district gold and galena are associated together. With few exceptions the veins lie rather flat and at some distance up the sides of the very deep and rugged cañons. The deepest mine is the Keynote, which has been opened 700 ft. on the incline. The ores from the mines of this district are free milling on the surface, but with depth there is an increase of copper and iron pyrites. Those portions of the veins carrying copper are said to be richer in gold. Some of the veins are very regular and well defined, while others are pockety. The influence of the wall on mineral deposition is shown in a vein in Robles Cañon, where the gold content is replaced by silver on the passage from granite to limestone.

In the Alabama Hills, 5 miles north of Lone Pine, there are several small veins near the contact of granite and porphyry. The gold is in part free milling and in part contained in iron and copper pyrites.

At the western base of the Inyo range, and southeast of Independence, is a group of mines, the most of them occurring in limestone. Although gold is the most important mineral found here, there is in some places a large amount of argentiferous galena.

In the same range, and about half way between Independence and Big Pine, is a prominent vein traceable for a mile in the granite. The ore here is in part free milling and part sulphurets.

The Fish Springs District is situated on the western side of Owens Valley, between Independence and Big Pine. The gold-bearing veins of this district are found in granite, and are small but rich. The gold is in part free and in part contained in iron and copper pyrites.

The next gold deposits of any consequence in a northerly direction are found along the western slope of the White Mountains, east and northeast of Bishop Creek. This mineral belt extends from Redding Cañon north about 10 miles, and is characterized by a great variety of formations. In Redding Cañon are small but rich veins of gold-bearing quartz. On the surface the gold is found free, but there are traces of sulphurets. The country rock is granite. One mile north is the Polita Mine, where occurs a vein of free-milling gold ore inclosed in limestone. The quartz is quite different from that of veins found in granite, being very porous and friable, and in places is almost replaced by oxides of iron in varying colors. Farther north is the Yellow Jacket Mine, where the vein is inclosed in slate. Still farther north is the Southern Belle, also in slate. The soft ores heavily impregnated with iron resemble that of the Polita. Several miles distant are the Dark Horse and Mabel mines, whose veins are inclosed in limestone. The quartz is friable and deeply stained with oxides of iron. The Sacramento Mine terminates this mineral belt on the north. Here is a rather flat ledge in granite. The quartz is hard but honeycombed, and contains a large amount of pyrites. The Polita and Southern Belle are the deepest mines in the belt, and have been found to maintain their strength in the deepest portions.

Gold is not found in paying quantities in the northern part of the

White Mountains, but silver appears in places. Much of the area occupied by the metamorphic rocks has been more or less mineralized, as shown by the abundance of iron pyrites producing a reddened surface.

Gold and silver both occur in the mountains between Bishop Creek and Mono Lake. The gold is found mostly between Benton and Owens River. With the exception of the Wild Rose, Neal, and one or two other properties, the mines have been but slightly worked. The veins are generally small. The country rock is granite. Silver and gold are associated in about equal proportion in the Wild Rose. The vein on which the Neal Mine is situated is remarkable for its size and regularity, and for the distance which it can be traced.

From Pine Creek north the eastern slope of the Sierra Nevada consists in part of metamorphic rocks. These, as well as the granites, are mineralized in many places. The deeply reddened rocks form an almost continuous but irregular line from Pine Creek north to Alpine County. The first gold deposits are found at Mammoth, in southwestern Mono County. Here are a number of veins outcropping on what is known as Mineral Hill. Many claims were located and a large amount of work done here years ago, but most of the ore is low grade and not free milling. It would appear that mining might be successfully carried on with the present methods for reducing low-grade ores.

Gold-bearing veins have been found southwest of Grant Lake, and on Lee Vining Creek, but have not been developed. West of Mono Lake, between Lee Vining and Mill creeks, are a number of gold prospects. Some of them are rich, but there has not yet been enough development work done to show their extent. The country rock consists partly of granite and partly of the metamorphic series.

One of the most important mining districts situated on the eastern scarp of the Sierra is the Homer, near the head of Mill Creek Cañon. A large mass of granite has been intruded through the metamorphic series on the southern side of the cañon. The gold-bearing quartz veins are mostly confined to the granite, which culminates in Mount Scowdan, 11,000 ft. high. The quartzites, porphyries, and slates have been impregnated with iron pyrites and present deeply reddened surfaces. Mount Scowdan is fairly seamed with quartz veins on the north, southeast, and over the summit. The May Lundy group, which has been the main producer, lies on the southeast slope of the mountain. Many of the veins are quite flat, but experience has shown that with increased depth they become steeper. All the ores from this mountain were free milling on the surface, though containing some argentiferous galena. With depth they undoubtedly become more base, as has been demonstrated recently in the May Lundy and Lakeview mines, where in the deeper levels the gold is found almost wholly contained in iron pyrites.

Near Green Creek, between Mill Creek and Bridgeport, are a number of mines, the most important of which is the Dunderberg. Here occurs a well-defined and regular vein inclosed in slaty rocks. On the surface the ore was partly free milling, but at the water-line the gold was found to be contained wholly in iron pyrites.

The mines of the Jordan District are situated north of Mill Creek, on the very edge of the eastern scarp of the Sierra. Here is found a vein of remarkable proportions running north and south between limestone and metamorphic rocks or porphyry. The enormous body of ore, 60 ft. wide in places, carries about equal amounts of gold and silver, and



although free milling on the surface, the deepest workings show an increase in sulphurets.

The Bodie District has been thoroughly described in former reports. It might be added that the country rock is hornblende andesite, an exceptional wall rock for California gold ores. The greatest depth reached, about 1,200 ft., has shown that the rich ores are nearer the surface, becoming poorer below the 500 ft. level. From the fact that the richest ore was the shallowest in the Syndicate Mine on the north and deeper in the mines lying south, it has been thought that the ore shoot might pitch south, and that rich ores still exist in that direction. Be this as it may, the ore of this group of veins has apparently given out at a moderate depth, a condition quite exceptional in the gold regions of California. The ores are free milling at the greatest depth reached, appearing to differ in that respect from almost all the mines examined on the eastern side of the Sierra.

Of the gold ores of the region under discussion it may be said, with few exceptions, that in depth they will become more base, the water-line varying greatly in different sections, and to successfully work a large number of these deposits provision must be made for concentrating the sulphurets. Although no great depth has been reached in most of the mines outside of Bodie, yet in many places the developments have been sufficient to indicate that the ores go down.

The deposits of silver and lead are more easily described under two heads, namely: silver merely, and silver-lead or argentiferous galena. Under silver ores are included argentiferous copper glance, stromeyerite, stetefeldtite or partzite, gray copper, and argentite. These ores are found chiefly in quartz veins generally well defined and similar to those of gold, with which they are often associated. The distinctly silver-lead deposits are, on the other hand, found more often in chamber form; that is, in irregular bunches scattered along a mineralized zone.

The Panamint range is noted particularly for its silver deposits, argentiferous copper glance, stromeyerite, etc., and the rare occurrence of lead ores. The two most important districts are Panamint and Wild Rose. The mines of the former are grouped mostly around the town of Panamint. The deposits are in the form of well-defined veins with a gangue of quartz, and are inclosed in limestone or other metamorphic rocks. The ores are mostly low grade, and at present are not profitable to work. The section is well favored with wood and water.

Wild Rose Springs are situated in the northern part of the range. The silver mines lie east and north of the springs from 3 to 15 miles, many being remote from water. Although generally occurring in vein form, the ores being similar to those at Panamint, the deposits are not so regular or well defined; a condition due, perhaps, in part, to the exceedingly broken character of the country, the dynamical action having been intense. Some of the ores are high grade, but so little depth has been reached that their extent is not known.

About Benton, and particularly in the vicinity of Blind Spring Hill, extensive deposits of rich silver ores have been worked for many years. Those in Blind Spring Hill occur in well-defined veins in granite, the ore being part galena and part stetefeldtite or partzite, the latter carrying the bulk of the silver. These mines are by no means exhausted, but are mostly idle because of the low price of silver.

The silver mines of the Patterson District, Sweetwater range, are at

present mostly idle. No lead ores are found here. The Kentuck group of mines has been a large producer in years past. The California Comstock and many others in the district have not yet been sufficiently prospected to demonstrate their value, although it is believed that large bodies of ore are present which can be mined if silver rise in value. Many of the veins found in the lower portion of the Sweetwater Mountains have been worked for gold.

The metaliferous deposits of Alpine County occur partly in andesitic tufas and partly in diabase and metamorphic rocks. About Monitor the degree of mineralization shown by the decomposed yellow and reddish-stained mountains is remarkable. Comparatively little galena is found here. In addition to the silver there is a small content of gold. Enargite is the rich silver ore.

The northern part of the Argus and the southern part of the Inyo ranges are noted for their extensive deposits of argentiferous lead ores. It is from the mines in the vicinity of Darwin and Cerro Gordo that the great bulk of the lead and silver of the region has come. A mineralized zone extends from the Modock Mines to and past Darwin. The mines at Modock and Minnieta are characterized particularly by the chamber form of the deposits. They have been opened to a depth of over 1,100 ft., and found to maintain the same character as near the surface. The Defiance Mine at Darwin has reached a depth of 600 ft., and recently a rich strike has been made. At Cerro Gordo the deep workings have been abandoned for the present, at least.

On the eastern slope of the White Mountain range argentiferous lead ores are found, but no work is being done on them at present.

Several small beds of iron are known in the southern part of Inyo County, but probably they are not extensive enough to be developed for that metal. They have been used quite extensively in the smelting of silver ores at Darwin and Modock. Copper is known to exist in Mono and Alpine counties, but has not yet been profitably mined.

The antimony (stibnite) deposits of Wild Rose Springs will be valuable when better facilities for shipment exist.

Quarries of marble and travertine have been opened, while an excellent granite is found in the Argus range.

The important borax deposits occur in Saline Valley, Death Valley, Salt Wells Valley, and in northern San Bernardino County.

## GEOLOGY OF A SECTION OF EL DORADO COUNTY.

EMBRACING PORTIONS OF THE PEKIN, AGRA, GREEN VALLEY, PILOT KNOB, AND MUD SPRINGS DISTRICTS.

By HAROLD W. FAIRBANKS.

In the southern part of El Dorado County and west of the so-called "Mother Lode," lies a mineral region of considerable importance. It has a width of about 5 miles west from the Logtown divide, and extends from the Cosumnes River north to the middle of the county. It is separated from the "Mother Lode" by the great diabase ridge which extends north from the Cosumnes River nearly to the town of El Dorado, while for a number of miles on the west it is bordered by a large area of gabbro. The sedimentary rocks of the district are more prominent in the eastern portion, and consist almost entirely of black slate, which is geologically a portion of the black slates of the "Mother Lode," the whole being known as the Mariposa beds. The general strike of the slates, when not disturbed by local eruptives, is north and south, dip nearly or quite vertical. The greater portion of the rocks of the district are, however, to be classed among the eruptives. They are in many cases greatly decomposed and, in the induced schistose structure, are often mistaken for metamorphosed sediments. This schistose structure has also a north and south direction. The variation in character and composition of these eruptives is quite remarkable; and though many of them possess a dike form with greatest length from north to south, yet others occur with the greatest irregularity, with reference both to form and position. Especially is this the case south of Shingle Springs in the vicinity of the Big Cañon Mine. The direction of the numerous quartz veins corresponds in general to the strike of the slaty or schistose structure of the country. This region was rich in placer gold in the early days, but for some reason quartz mining seems not to have been generally successful. This has been due in part to the "pocket" character of many of the veins. The low-grade but more uniform gold deposits have not until recently been systematically developed. In addition to the north and south system of veins there is an east and west system, less important, however, and always "pockety." The presence of *quicksilver* in addition to gold is a peculiar feature of this section. The most important rock formations, slate, greenstone, serpentine, and porphyries, will be described in the order of their extent.

As before mentioned, slate forms the eastern part of the district, forming a belt from a mile to a mile and a half wide. It is cut by many dikes of a fine green rock, and others of hornblende and quartz porphyry. With few exceptions the quartz veins are not found in the slate, but at the contact with the eruptives or inclosed in them. Near the Fort Yuma Mine a small vein, perhaps 15 in. thick, of *chromite* is found in the slate, no serpentine cropping within a mile or more. This is the first instance in this State which has come to my notice of chromite occurring associated with any other rock than serpentine, with which it has seemed to be genetically related.

The greenstone or greenstone schist, varying to talcose schist, forms a



large part of the section under discussion. Beginning west of Big Cañon it increases in importance northward toward the Pyramid Mine. In fact it forms nearly the whole country, with the exception of the serpentine between Gray's Flat and the slate belt. This greenstone has been derived from a massive crystalline rock by pressure and resultant decomposition. Quartz veins are very numerous in it, some of them belonging to the east and west system. Float quartz is abundant, and all the gulches show signs of having been sluiced. South of Shingle Springs the greenstone appears in the form of dikes. Between these are long narrow arms of metamorphic rocks, chiefly silicious schists. In these schists, which largely replace the greenstone west of the Big Cañon Mine, are the veins on which are located the Vandalia, Knob Hill, Crystal, and French Creek mines. Beginning at Shingle Springs and following the top of a ridge which extends southward, an almost continuous series of quartz croppings can be traced across French Creek and over Agra Mountain, a distance of fully 6 miles. These deposits are of a "pocket" character, and have been found quite rich in places. The ore body of the Big Cañon Mine, which cannot be traced north or south any great distance, seems to belong to a mineral zone which can be followed from the Live Oak Mine northward, west of Big Cañon and east of French Creek, nearly to the railroad. Two lenses, at least, in addition to that of the Big Cañon Mine, and of the same character, occur along this belt, besides quartz veins of the usual character.

Serpentine outcrops for about half a mile along the Cosumnes River above the mouth of Big Cañon. Extending northward it can be traced across the latter stream, and then narrows down to small proportions, appearing occasionally as far as Shingle Springs. A small body of serpentine forms the hanging-wall of the Big Cañon Mine. In the direction of the Greenstone Mine other outcrops appear. From the latter mine an almost continuous body of serpentine extends northward for several miles, increasing to large proportions. Granite porphyry outcrops east of the diabase at Logtown. This rock narrows northward, but can be traced for several miles to and beyond the Davidson Mine. Another considerable area of similar porphyry forms the hill through which the railroad tunnel 2 miles east of Shingle Springs is run. A strongly mineralized zone was cut in the tunnel, the fissure being indicated by a spring of mineral water which leaves a heavy iron deposit.

In the vicinity of the Schleifer Mine, 3 miles south of the Big Cañon Mine, are a large number of bunch-like outcrops of a hornblende porphyry. A similar rock forms a large portion of China Hill. A number of diabase outcrops appear in the railroad cuts, but none so well characterized as that at the Big Cañon Mine.

The gold-bearing deposits may be divided into two general classes. To one class those best illustrated by the Big Cañon Mine belong, while to the other belong the white quartz veins formed after the usual manner. The Big Cañon ore body may properly be considered as a deposit by replacement, and is characterized by the even distribution of the gold, and small, well-formed crystal of iron pyrites. Two miles up the creek is a similar deposit, in which the process is not so complete and the transitions may be more closely followed out. The Shaw Mine may be considered as occupying an intermediate position between the types represented by the Big Cañon ore body and the ordinary quartz vein. In past years more attention was given to the veins of pure quartz, which were often found to be pockety, but it seems to me that the more permanent developments

of the future must be on the large ore bodies of low grade, chiefly the replacement deposits, of which a number have been described. To get at the relation of the veins to their walls, if any such relation, other than a physical one, exists, is indeed a difficult matter, on account of the variety and complexity of the eruptives. My own observations have led me to believe that the physical relation is the only one of which there is any evidence. Traces of minerals are found almost everywhere associated with every kind of rock present.

The following extract from the "American Journal of Science," Vol. XLVII, pp. 470 to 471, by Mr. Turner, of the U. S. Geological Survey, will be of interest with the above:

"*Gold in Albite.*—As is well known, free gold usually occurs associated with quartz as a gangue. Instances are on record, however, of its occurrence in various materials, as talc, calcite, etc. Recently a series of specimens was sent to the writer by Mr. Leo Von Rosenberg, of New York City, from the Shaw Mine, in El Dorado County, about 4 miles southwest of Placerville. This deposit occurs in clay slates associated with a dike or dikes of a feldspathic rock, which appears to be devoid of bisilicates. Judging from the specimens forwarded, the dike rock is more or less decomposed, and is at some points replaced by secondary white feldspar, which at other points cuts the dike rock into little seams. This feldspar is well crystallized, and with the aid of a lens striations may be noted on the crystals. In thin section these feldspars are seen to be twinned polysynthetically with extinctions proper to albite, and a partial chemical analysis by Dr. Hillebrand, of the U. S. Geological Survey, shows that it contains soda, no lime, and about 19 per cent of alumina. It is therefore albite. In two specimens of this crystallized albite there is free gold. Another interesting specimen is of a dark, fine-grained rock, which appears to be an aphanitic form of the dike rock, in a seam of which free gold with a little calcite has been deposited.

"The following is a partial analysis, by George Steiger, of the feldspar of the grayish-green dike rock forming part of the Shaw Mine lode:

(No. 452, Sierra Nevada collection.)

Alumina .....	About 20.00
Lime .....	.49
Potassa .....	1.15
Soda .....	8.72

"This would indicate that the feldspar of the dike rock is also albite, although not so pure as the secondary albite that occurs in veins cutting the dike rock.

"The feldspathic lode of the Shaw Mine is cut by little veins of quartz; but judging from the specimens sent, these are not very abundant, and do not seem to be connected with the deposition of the gold.

"The quartz veins cut the veins of secondary albite, showing that they were formed later than the albite. In one specimen there seemed to be an intermingling of quartz and albite, pointing to contemporaneous deposition. But in thin section, the idiomorphic albite crystals were plainly seen to be inclosed in the quartz as if there had been a little fissure, the walls of which were coated with albite crystals and the open spaces in the middle between the albite crystals later filled in with quartz. All of the material of the lode, except perhaps the quartz, contains iron disulphide scattered through it in minute cubes, and calcite in little rhombs and particles."

## ANCIENT CHANNEL SYSTEM OF CALAVERAS COUNTY.

By W. H. STORMS, M.E.

The extensive system of ancient rivers, remnants of which are found along the western foothills of the Sierra Nevada, from the northern counties as far south at least, as Mariposa County, is very prominent in Calaveras County, where the aggregate length of the main channels and their branches exceeds 100 miles. Of this about 25 per cent has been cut away by the erosion of recent streams, and 25 per cent has been mined, leaving 50 miles of auriferous gravel, a very large portion of which will undoubtedly pay to mine.

The greater portion of this system of channels is quite simple, being represented by winding courses and an occasional tributary, but some portions, as at Vallecito, and more particularly at Mokelumne Hill, are very complex. In order to render an understanding of the system more complete, two maps have been prepared, one showing the remarkable channel system in the vicinity of Mokelumne Hill, and the other the channel system of the county.

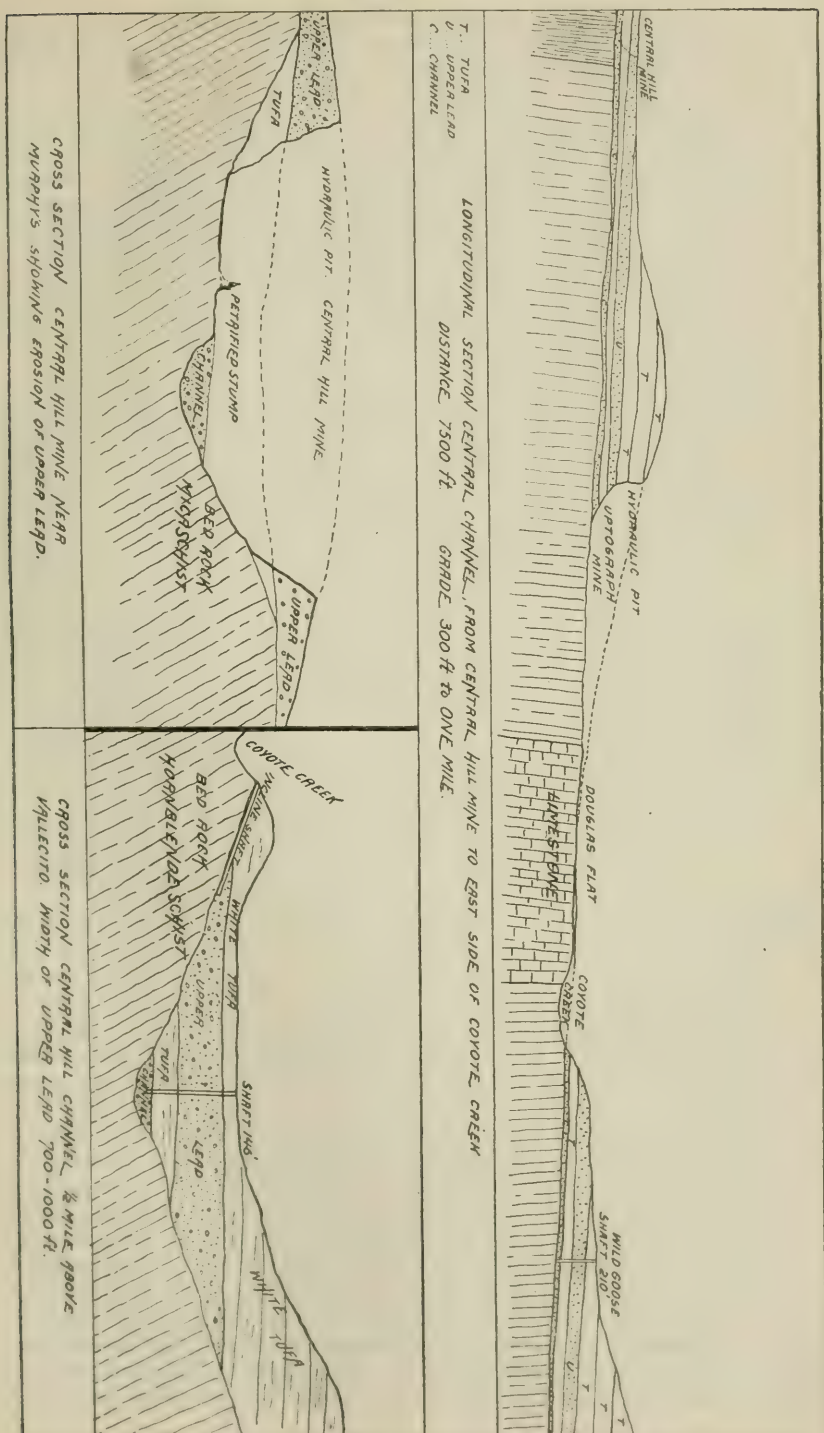
## CENTRAL HILL CHANNEL.

About the town of Murphys, where the study of the northeast branch was begun, this channel flows in a southeasterly direction, turns south, passes through Vallecito, and thence west to the vicinity of Altaville. Passing west near San Andreas it is found to continue through Central Hill and on toward Valley Spring.

At Vallecito the Central Hill channel is joined by two small tributaries from the east and south; that from the south was quite superficial, and was hydraulicked in early days. The other, known as the Murphy's Gulch channel, has been drifted upon somewhat.

A drain tunnel 3,200 ft. in length is being driven from Douglas Flat into the Central Hill Mine. This mine was formerly worked by the hydraulic method, but as the work was down grade, lack of dump put a stop to mining. The next mine south on this channel is the Uptograph or Buckminster claim. A large amount of gravel was hydraulicked here years ago, the face reaching a great height, when the quantity of volcanic tufa becoming so large, this method of mining was abandoned. Drifting on an upper lead is now in progress. From Douglas Flat to Vallecito, and for some distance beyond, the claims are mostly owned by the Vallecito Mining Company. This concern has in course of construction a ditch and flume 26 miles in length, and also has in contemplation the building of a storage reservoir at Bear Valley, in Alpine County. A tunnel 7,000 ft. in length will be driven under the channel, from Coyote Creek, to drain this large property, which cannot be worked otherwise. Whenever bedrock has been reached on this portion of the Central Hill channel the results have been very flattering.





At the Central Hill Mine the volcanic cap has been completely removed by erosion and the broad upper lead swept broadcast over the immediate vicinity, forming rich superficial placer deposits, which were mostly worked out many years ago. A layer of white volcanic ash (tufa) separates the upper and lower leads. In the Uptograph Mine only the basalt and the upper part of the tufa have been eroded, leaving nearly 100 ft. of white tufa capping the upper lead, which is separated from the channel lead by about 15 ft. of tufa. This channel is quite variable in width and also in grade. In the Uptograph Mine the channel is 40 to 60 ft. wide, narrowing with a heavy grade to 10 or 20 ft. In Vallecito Flat the channel is over 100 ft. wide, and below the confluence of the tributary channels is more than 200 ft. The upper lead is exposed more than 1,000 ft. wide on Coyote Creek, half a mile above the village of Vallecito.

East of the Central Hill channel is another capped with brown volcanic mud, which is overlaid by white tufa, and this in turn by black basalt. This channel comes from the northeast, and has been identified as far in that direction as Sec. 22, T. 5 N., R. 15 E., M. D. M. The channel comes from the direction of the Calaveras Big Trees. Its course is southwest as far as Vallecito, where it turns south and then southeast, crossing the Stanislaus River into Tuolumne County. It is undoubtedly a portion of the great Table Mountain series. In Calaveras County it is known as the Cataract channel. The channel has been worked here and there, and a few men are employed all the year drifting. The greater part of the channel remains intact, but has suffered more or less disturbance, the strata often being found tilted.

That portion of the Central Hill channel lying between Vallecito and Altaville is largely unworked. Between Altaville and San Andreas the channel has been worked in many places both by hydraulic and drift methods. Drift mining on a small scale is being carried on in a few claims only. A great deal of this portion of the Central Hill channel has never been worked. By far the larger portion of the channel, from the vicinity of Vallecito to San Andreas, is covered by agricultural patents.

High lava-capped ridges on the north side of Mokelumne River mark the course of a gravel channel, which, with its lateral branches, constitute a large system. It enters Calaveras County about  $2\frac{1}{2}$  miles east of West Point on the high hills south of Mokelumne River, and extends in a southerly and southwesterly direction toward San Andreas, passing not far from the village of El Dorado. The sinuous course of this stream, the main branch of which is called Fort Mountain channel, is laid down on the map.

The erosion of this channel system has been considerable, but the greater portion remains. It has been "drifted" to a limited extent in many places, and in a few places where the channel has been exposed by the erosion of recent streams, hydraulicking was formerly employed. Within a year or two marked attention has been paid to this channel by organized companies for the purpose of drifting, as most of the bed-rock lies below the level of present surface drainage of the country. Near El Dorado, on the Sheppard Mines, a well-boring plant has been used to advantage in determining the depth of underlying gravel, and the probable yield of gold per ton. The depth to bedrock ranges from 50 ft. in the cañons to 400 ft. and even more on the ridges. A

large part of this channel system lies buried beneath volcanic rocks, partly white tufa, partly volcanic mud, and a fragmental material consisting of well-washed sand and gravel, formed from basaltic and andesitic rocks. All of this volcanic material, strange as it may appear, contains both gold and silver. Assays on several samples showed the presence of gold in value from 50 cents to something over \$1 per ton, with 2 or 3 ounces of silver. It is said that in places assays as high as \$20 per ton have been obtained from a dark-colored tufaceous material, but no such place was found by the writer. It is an interesting fact, that gold and silver do occur in this volcanic cap.

The gravel of the bedrock channel of this system is often found to be cemented, though not firmly. Near El Dorado an arrastra was built to work this material. The gravel is dumped into the arrastra basin, which is 12 ft. in diameter; the drags are run rapidly, and a stream of water under pressure turned on the gravel from a pipe. The result is a rapid and effectual disintegration of the gravel. The discharge is open and without screens. The gold is caught in the sluices set below the arrastra, no attempt being made to catch gold in the basin of the arrastra. The estimated capacity is 50 tons per day for each arrastra. There is no doubt but that this device can be used to good advantage on much of the loosely cemented material now being passed through stamp mills.

The Fort Mountain channel comprises 40 miles of auriferous gravel beds in Calaveras County, nearly half of which has neither been eroded nor mined, but by far the larger portion of it, as well as of the Central Hill system, is covered by agricultural patents, mostly homesteads.

The Fort Mountain and Central Hill systems join, as nearly as could be ascertained, in Sec. 27, T. 4 N., R. 12 E., M. D. M., which is about 3 miles east of San Andreas, and a mile from the confluence of Willow and Calaveritas creeks. The united channel then flows west to and beyond Central Hill, where the entire Mokelumne Hill system also concentrates, the three great systems passing beneath the Golden Gate Mountain ridge in the direction of Valley Spring.

The Mokelumne Hill system will only be considered as it appears between the south side of the Mokelumne River and its junction with the united Central Hill-Fort Mountain systems in the vicinity of Central Hill.

On the hills about San Andreas the Central Hill-Fort Mountain channel only appears as remnants. A mile west of the town a remnant capped with white tufa has been worked out. Beyond it again disappears, but is again found  $2\frac{1}{2}$  miles west from San Andreas, on Jackson Hill, and again on Central Hill, in the Duryea, Union, and Reed claims.

Within the townsite of San Andreas are two gutter-like channels, now worked out, and said to have been very rich. One of these lies along the south side of the town, and is capped with a breccia of basaltic and andesitic pebbles, apparently similar to the rocks capping the larger channels mentioned, and is evidently later than the great channels.

The other "gutter" is on the north side of the town. Half a mile down the gulch it is found to be capped with white tufa. In places, lying on the surface of the loose gravel, 60 ft. above bedrock, are found great masses of diabase similar to that about San Andreas.

These rocks are sub-angular, not rounded. They might, at a passing glance, be mistaken for outcropping masses of rock in place. Some of



them weigh 300 tons, and many of them exceed 50 tons in weight. There is no doubt that they are of local origin, and came into their present position by becoming detached from the rim rocks, which were doubtless steep. The rocks lying on the gravel were evidently carried down stream a short distance at the time of a great flood, or series of floods, which, while removing large quantities of gravel, permitted the great rocks to sink lower, but not moving them any considerable distance. The present position and appearance of these masses indicate that the superficial gravel was swept away quickly, as the long-continued scouring of sand and water would certainly have resulted in rounding the masses of diabase.

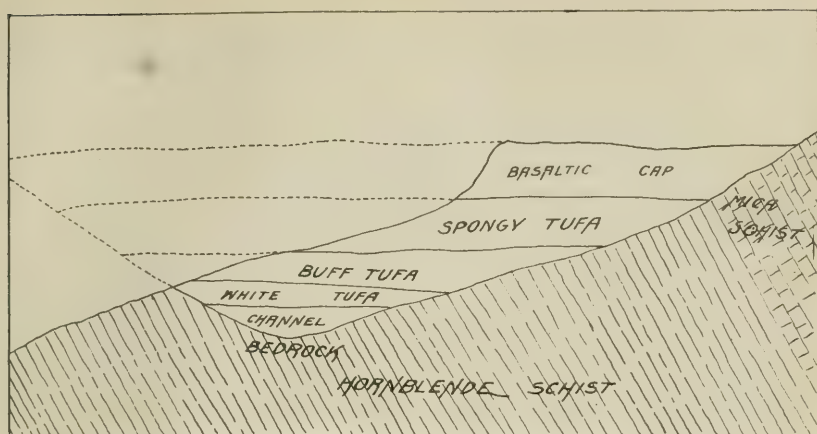
#### MOKELUMNE HILL SYSTEM.

As has been stated, the system of ancient river beds in the vicinity of Mokelumne Hill is very complex. An area of 20 square miles was investigated for the purpose of determining their geological relations to one another and to the Central Hill-Fort Mountain systems. Nine distinct channels, having each its own peculiar characteristics and geological age, were identified and platted on the map. It was found that the relative altitude of the several channels could not be taken as an indication of their respective age, though ordinarily the higher channels are the older and the low ones younger; that is, more recent. The channels of greater altitude lie high above the modern drainage system, while the low ones are still lower than the gulches in their immediate vicinity. The Mokelumne River, however, has cut its magnificent cañon 500 ft. deeper than the lowest of these ancient rivers. With two exceptions, the Kreamer and the Concentrator channels, the relative age of the channels is determined by the relative altitude. The two exceptions are not found intersecting any of the other channels, and their relation to the rest is in some doubt. On a petrographical basis, the Kreamer channel would be considered younger than most of the others, notwithstanding the fact that it is a high channel. The wash consists of quartz and lava boulders, cobbles, and gravel.

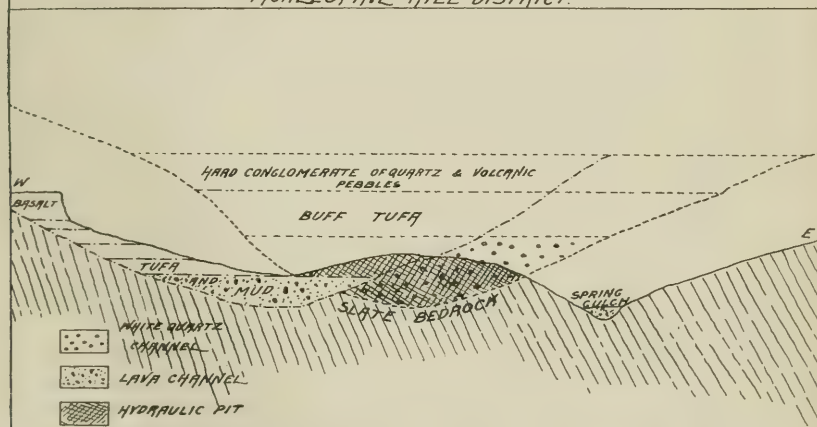
The Concentrator channel is lower than its near neighbor, the Duryea channel, but is evidently older. These two important channels lie side by side for several miles, having been identified in Butte Basin in Amador County.

A great portion of the deeper channels (by which is meant those of lowest altitude) are still unworked. A great amount of the Old Woman's Gulch channel and the Chile Gulch channel is not worked out. The high channels are mostly exhausted, having been worked years ago, producing millions of dollars. It is stated by the mining men of this vicinity that the tailings in the Chile Gulch contain \$5,000,000 in gold. Though probably exaggerated, there is doubtless a large amount which cannot be extracted for lack of dumping ground.

Within the southern limits of Mokelumne Hill, beneath Stockton ridge, is the highest and oldest channel of the district. It was fabulously rich. The hill is a labyrinth of shafts and drifts. Little could be learned of this famous channel. Its course is south. Under Stockton ridge it was cut by the more recent channels coming in from the west. A remnant of a channel 3 miles south is probably a portion of this channel.



CROSS SECTION CORRAL FLAT CHANNEL WEST SLOPE, FRENCH HILL  
MOKELUMNE HILL DISTRICT.

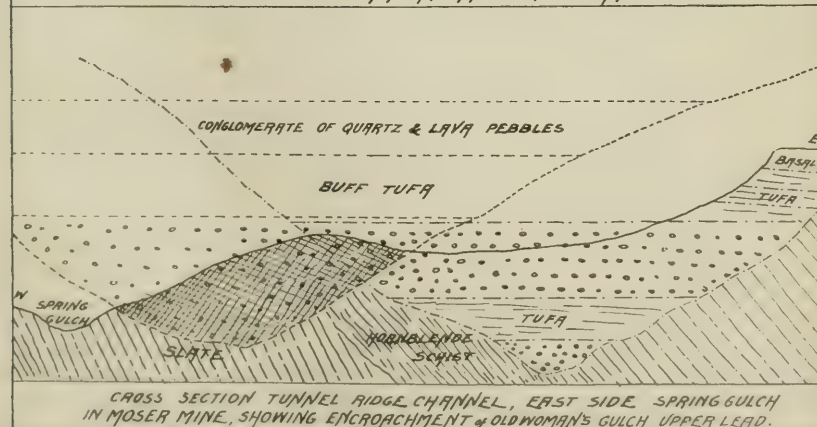


1<sup>ST</sup> PERIOD

2<sup>ND</sup> " "

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CROSS SECTION TUNNEL-RIDGE CHANNEL SPRING  
GULCH NEAR HAPPY VALLEY MINE



CROSS SECTION TUNNEL RIDGE CHANNEL, EAST SIDE SPRING GULCH  
IN MOSER MINE, SHOWING ENCROACHMENT OF OLD WOMAN'S GULCH UPPER LEAD.

At the northeast corner of the town is an eminence called French Hill. On its west side, half way up the hill, is a remnant of channel which is a portion of the famous Corral Flat channel, which also extended under Stockton ridge in a southwesterly direction. This is said to have been the most productive channel for its size of any in the district. The characteristic features of this channel are the uniformly gray color of the wash; the large amount of bluish slaty quartzose rock; relatively small quantity of well-rounded quartz boulders; blue quartzite and considerable eruptive rock, felsitic and granular, having a smooth, well-washed appearance. The most prominent feature is the numerous cobbles and boulders of hematite. The channel on French Hill is 40 to 60 ft. wide. It is somewhat wider under Corral Flat. The large angular quartz boulders found in the channel on French Hill were derived from a massive quartz vein a short distance to the east. The channel is capped by a tough, putty-like tufa, which is overlaid by a reddish andesitic lava, containing many well-formed crystals of hornblende.

A mile east of the center of town is the Tunnel Ridge channel. It evidently came from the north side of the Mokelumne River, but makes its first appearance in Happy Valley, from which point it extends south some distance, its course being marked by a succession of large, red hydraulic pits. The larger part of this channel is worked out. The removal by erosion of the lava and tufa from the greater portion of its course adapted it to the hydraulic method of mining. In the Moser Gravel Mine, on Spring Gulch, this channel is 200 ft. wide; 3 miles south its width is about 40 ft.; its average width is 80 ft., and the grade about 100 ft. to the mile, but this is extremely variable. The distinguishing features of this prominent channel are the large amount of white and blue quartz boulders, some of which are of gigantic size. The wash contains an equal amount of grayish or bluish stratified quartz rock, derived from quartzites and silicious schists; a large amount of sub-angular pieces of slaty and schistose micaceous rock lying high above bedrock and evidently not of local origin; a white micaceous sandstone (a variety of itacolumite, only slightly flexible). Acid lavas, such as felsite, quartz-porphyry, and rhyolite are not found in this channel. The gold of Tunnel Ridge is high grade, a noticeable fact in all channels in which there appears to be an absence of old eruptive rocks (not basalt or andesite), while on the other hand the channels in which such rocks occur generally produce gold of lower grade. As a matter of course this rule or condition will not apply where two channels, one containing old eruptive rocks and the other not, have united to form one channel or have crossed each other. In the latter event the later channel will contain two kinds of gold below the crossing, as well as the channel formed by the union of two such channels, as described.

Tunnel Ridge channel presents a number of interesting cross-sections, showing the encroachment of later channels and the effect of recent erosion.

The Concentrator and Duryea channels make their first appearance in Calaveras County a mile west of Mokelumne Hill as remnants capping a hill. They reappear in their southerly course on the western slope of Stockton ridge, and have been worked extensively under that lava-capped mountain. They lie within 200 ft. of each other for more



than a mile, but about the middle of the ridge they diverge, the Duryea channel maintaining a nearly straight course, and the Concentrator channel bearing to the south. The Duryea channel appears on the west side of Chile Gulch, a mile south of Mokelumne Hill, the Concentrator being again exposed in a large hydraulic pit opposite the Chappellet drift mine, 2 miles farther down the gulch. More than a million cubic yards of gravel have been washed from the Duryea pit, and the workings extended back under the Stockton ridge for several thousand feet. This famous channel is distinguished from all others of the district by its almost exclusive quartz wash. Rounded, smooth bowlders and cobbles and angular or sub-angular masses of white quartz and quartz sand constitute the material of this channel to the exclusion of almost everything else; occasionally a gray or bluish boulder of quartzite may be observed, but no eruptive rocks, iron ores, or other material is seen. The gold of this channel is high grade.

The Concentrator channel has a heavy wash of quartz and quartzite and considerable hematite. The variety of rock, while not large, is easily distinguished from that of the Duryea channel. Both of these large channels are cut out by the Chile Gulch deep lead, and have never again been positively identified to the south. They apparently merge into other channels or are eroded entirely. There is some reason to believe that the Duryea channel joins the Tunnel Ridge channel.

Two miles northeast of Mokelumne Hill is a gutter-like channel 20 to 60 ft. wide, with steep rims. The grade is about 80 ft. to the mile in that portion of its course. It is very sinuous; the most erratic channel, in fact, of any in this region. Along its upper course, between Indian Gulch and Mokelumne River, the tufa which at one time covered the gravel has been mostly removed by erosion, which has also cut out large portions of the gravel. The gulches below were very rich and were worked out years ago. Active mining operations are in progress on one portion of this channel, at the Phillips Mine, the hydraulic method being employed. This channel comes to an abrupt termination on the east side of Indian Gulch, in what is known as the Gopher claim. The hydraulic pits which mark the course of this channel are deep red, and the wash consists of white and dark-bluish quartz bowlders and cobbles, silicious and light-brown ironstone, masses of flint, a small amount of hematite in cobbles and pebbles, considerable slaty and schistose bedrock, and more or less rock of igneous origin. The wash, though deep red where oxidized, is blue or greenish-blue near bedrock where atmospheric agencies have not affected it. Twenty feet above bedrock the gravel is found to be interstratified with irregular sheets of tufa having a peculiar light yellowish-green or bluish shade.

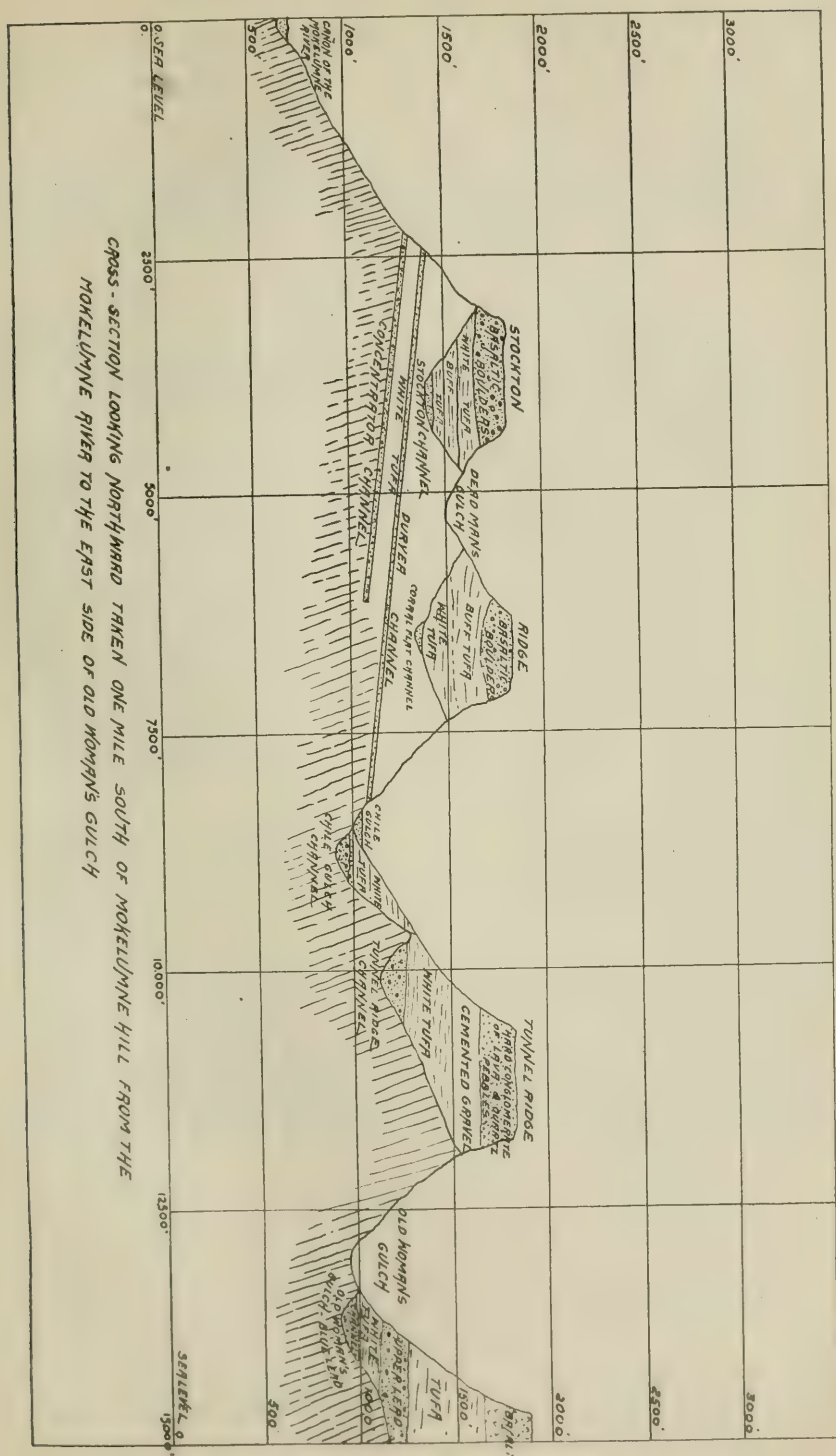
The character of the gravel, the appearance of the unoxidized wash, the interstratified tufa, the sinuous course of the channel, and its every important feature are so similar to the Chile Gulch blue lead that they are thought to be identical.

From the break on Indian Gulch to the point where the Chile Gulch lead is first found on the west side of Stockton ridge, the distance on the presumed course of the channel is about  $2\frac{1}{2}$  miles. The difference in altitude between the two points in question, as read by barometer, corresponds very fairly with the normal grade of the channel, which is about 80 ft. to the mile. In its passage under Stockton ridge, the Chile Gulch channel cuts out all the older channels in its course, viz., the

Stockton ridge, Corral Flat, and Duryea channels. It first appears on the east side of the Chile Gulch, half a mile south of Mokelumne Hill, where it is said to be about 60 ft. below the present bottom of Chile Gulch. In a general way it follows the gulch, but is much more sinuous than the modern stream, the ancient river sweeping from side to side, and at one place making a large horseshoe bend, as at the What Cheer Mine, where it is half a mile west of Chile Gulch. Its course is quite well defined for  $2\frac{1}{2}$  miles below the Duryea Mine, but it has been lost in the south end of the Chappellet Mine, and its course beyond has heretofore been a matter of conjecture, but there is much reason to believe that a continuation of the Chile Gulch channel is found in the channel whose course is marked by a series of red hydraulic pits beginning on the opposite side of Tunnel ridge from the Chappellet Mine and extending for some distance on either side of the road in the direction of San Andreas. This channel has every important feature of the Chile Gulch channel, and particularly resembles that portion of the stream in question found in the series of red pits of the Gopher and Phillips mines, northeast of Mokelumne Hill. The grade of this lower section of channel is extremely irregular. Where first observed opposite the Chappellet Mine, in Old Woman's Gulch, on the east side of Tunnel ridge, the bedrock is 15 ft. higher, by aneroid reading, than the bottom of the shaft in the Chappellet Mine, half a mile distant. Southward from the pit, on the west side of Old Woman's Gulch, there is scarcely any grade for half a mile, but in the next half mile toward San Andreas there is a heavy grade to the northward, beyond a moderate grade southward is again found, and near the property of the Spring Gulch Placer Mining Company the last traces of this channel are seen. Whether it also turned toward Central Hill is not known, though it is presumed it did. The southern end of the channel is only  $3\frac{1}{2}$  miles from the town of San Andreas. The channel is completely worked out, so its probable course becomes interesting from a geological standpoint only.

From the present knowledge of the channel system of this region it appears that the deep channel, called the Old Woman's Gulch Blue Lead, is one of the most recent of these ancient streams, having cut out every stream in its course, which is remarkably straight, with a broad upper lead. It first appears in the Maguire Mine, on the east side of Indian Gulch, a mile north of Mokelumne Hill, and but a few hundred feet northeast of the Happy Valley hydraulic pit, on the Tunnel Ridge channel. It courses in a southwesterly direction to Old Woman's Gulch, and from there its course lies mostly along the east side of that gulch as far south as Williams' ranch, on the San Andreas and Mokelumne Hill road; here it crosses Old Woman's Gulch and passes under Tunnel Ridge, intersecting the Tunnel Ridge and Chile Gulch channels. The upper lead is separated from the channel by about 60 ft. of light tufa. Both the channel and the upper lead have been worked at many points. The entire course of this channel from Indian Gulch for 2 miles or more to the south lies beneath the drainage of Old Woman's Gulch, and the problem of controlling the water has become a serious one to the owners. It would seem that a consolidation of interests and the running of a long drain tunnel would render the working of this channel practicable. The large amount of tough clay in this wash renders the speedy handling of the material difficult. It has been the practice of the miners to spread the gravel out in shallow layers; the "slacking"

CROSS-SECTION LOOKING NORTHWARD TAKEN ONE MILE SOUTH OF MOHELWINE HILL FROM THE  
MOHELWINE RIVER TO THE EAST SIDE OF OLD WOMAN'S GULCH





or "weathering" by exposure to the atmosphere seems to facilitate the recovery of the gold in the sluices. The course of this channel beyond the point where it enters Tunnel Ridge is toward Central Hill.

A channel filled with lava-wash (basaltic) and a few quartz bowlders and cobbles, crosses the top of Stockton ridge in an easterly direction. A similar channel is found on the west side of the Tunnel Ridge channel, near Happy Valley. These two remnants appear to be portions of the same channel. It has been drifted, but not extensively. Though actually the highest channel of the region it is apparently the most recent.

The Kreamer channel lies well to the west and has a course toward Golden Gate Mountain. It is being worked in places by the drift method. This channel appears to be the same as that passing through the Lava shaft and Augostini claims, near Central Hill, and it is not unlikely that the Benson Mine, on the west side of Latimer Gulch, is on this channel also.

An approximate estimate of the amount of gold still remaining in unworked portions of the channels of Calaveras County would be difficult to make, but basing such an estimate on the knowledge of what certain channels have already produced, and consulting all available data as to extent, average width, and depth, it would seem that \$15,000,000 is not an extravagant estimate of the quantity of gold that may be obtained by drifting. Besides this, it is probable that the upper strata contain as much as \$25,000,000 more, a large portion of which cannot, with present knowledge and facilities, be obtained economically.

The value of the gold from the several channels, as obtained from a gentleman residing at Mokelumne Hill, and who has mined in several of the channels and bought a large amount of the gold of the district, is given as follows:

Phillips Mine, upper end of Chile Gulch channel.....	\$18 25 per oz.
Chile Gulch Deep Lead .....	18 00 per oz.
Tunnel Ridge channel .....	19 50 per oz.
Old Woman's Gulch Blue Lead .....	17 50 per oz.
French Hill-Corral Flat channel.....	18 50 per oz.
Stockton Ridge channel .....	18 00 per oz.
Duryea channel.....	18 00 per oz.
Concentrator channel.....	17 75 per oz.
Kreamer channel .....	18 50 per oz.
Red pits on San Andreas road, presumed to be lower end of the Chili Gulch channel (about).....	17 50 per oz.

It will be understood that these are the prices paid for the gold, and that they do not represent accurately the fineness of the gold.

The subject of Ancient River Channels in California has heretofore been treated at length in our VIIIth, IXth, and Xth Reports, pp. 736, 105, 435.

GEOLOGY OF NORTHERN VENTURA, SANTA BARBARA, SAN  
LUIS OBISPO, MONTEREY, AND SAN BENITO COUNTIES.

By HAROLD W. FAIRBANKS.

The field work for 1893 in the southern coast ranges occupied five months. The writer, in company with R. P. Heagan, as assistant, traveled over 2,000 miles, visiting every known mineral deposit of any value, and examining the geology as far as was possible with the time at disposal. The geology was found to be more complex than the hasty reconnoissance the previous summer had indicated. Many interesting facts were discovered, for the full elucidation of which more detailed work is required. It is believed, however, that the work has been sufficiently accurate to serve as a basis for future detailed investigations.

Very little has been known of the geology of this portion of the coast ranges. The reports of the Pacific Railroad Survey, and of the former State Geological Survey under Professor Whitney, comprise the results of most of the work done here. The southern portion of the region studied, embracing as it does the San Emedio range, where the San Bernardino Sierra and the southern Sierra Nevada unite, is of great geological interest. The three dominating peaks of the San Emedio range are the Alamo, Frazer, and Pinos, ranging in the order named from over 7,000 to 9,000 ft. in elevation. This elevated region of crystalline rocks has a shape somewhat like a V, the apex formed by Mount Pinos lying to the west, while the arms extend one to the northeast, forming the Tehachapi range, the other southeast under the name of the Sierra Libre. Between these ranges is Antelope Valley, the western arm of the Mojave Desert.

Previous to the deposit of the Miocene-Tertiary this region had assumed topographical features somewhat similar to those of the present day, but during the Miocene a great submergence took place and only the tops of the highest ranges rose above the water. The Tertiary beds, consisting of sands and clays, were deposited in the previously eroded valleys, and to-day somewhat mask the real geological structure. The Miocene which forms a large part of the central and southern parts of Ventura County, extends up Soledad Cañon nearly to the Mojave Desert, while beds of the same age in the valley of the Piru completely cut off the Sierra Libre from the San Emedio range and extend through to Antelope Valley. The beds rise to an altitude of over 5,000 ft. about the sides of Frazer Mountain, where they are quite undisturbed and present a somewhat terrace-like appearance. The surface in places has apparently undergone scarcely any erosion since the elevation from beneath the sea.

The Sierra Libre range consists chiefly of a gneissoid mass with some granite, and is generally deeply decomposed. The gneiss is thin-bedded,

and in the San Francisquito Pass exhibits the most contorted foliation, while it is intersected in all directions by irregular quartz veins.

Tertiary beds extend up to the summit west of Gorman Station, where the old Los Angeles stage road crosses, and rise much higher against the slopes of Frazer Mountain. Tertiary beds appear again about the sides of Cuddy's Valley, between Mount Pinos and Frazer Mountain, and extend over the divide to Lockwood Valley. Westward from the latter point they become very prominently developed, forming the divide on the head of the Cuyama, and a great extent of barren mountainous country southwest and west of Mount Pinos. About Cuddy's Valley, which has an elevation of about 4,500 ft., the Tertiary rises nearly 1,500 ft. and is very distinctly terraced, three being noticeable on the north slope of Frazer Mountain. Overlying these clays unconformably are heavy deposits of boulders and gravel, which in many places are rich in gold. These gravels border all the high peaks of crystalline rock, and are particularly extensive along the head of the Piru between Lockwood Valley and Rays Creek. The older sands and clays carry no gold, indicating a submergence of the whole range during their deposition, and a period of partial submergence during the formation of the gold-bearing gravels. The gold has undoubtedly been derived from the quartz veins in the schists near by. Beginning about  $2\frac{1}{2}$  miles above the mouth of Lockwood Creek on the Piru are a series of terraced gravel deposits, extending in a westerly direction to San Quelmo Cañon (about 15 miles), which are said to carry everywhere more or less gold. Desultory mining has been carried on here for many years; in fact, these are said to be the earliest worked placers in the State. These gravels seem to have belonged to an ancient stream which diverged from the course of the present Piru more toward Mount Pinos, and, judging from the boulders, it may have headed there. South of the Piru at this point there are no gold-bearing gravels. The gold is not greatly worn and generally rather coarse. Farther down the Piru the gulches which head in the Alamo Mountain also contain gold.

Beginning on the southern side of the Piru near the mouth of the Alamo Creek, and extending in a northwest direction, is a series of very peculiar schists and gneisses with which the most important gold-bearing quartz veins are associated. These form a large part of Frazer Mountain, but are best exposed along the Piru and Lockwood creeks. They extend as far west as the southern slope of Mount Pinos. The strike is a little north of west, and dip to the north at a high angle. The schists are characterized by the development of alternate bands of feldspathic and hornblendic or micaceous material. Corroded feldspar crystals are scattered through the gneisses, being inclosed in a matrix consisting of irregular bands of gnarled, stringy masses of feldspathic material and layers of mica or hornblende. The gneissoid rocks often blend into well-characterized "eye" gneiss; that is, gneiss in which the generally large crystals of feldspar have undergone partial re-fusion, giving them a more or less elliptical form. These porphyritic gneisses are sometimes sharply differentiated from the schists, which at first sight seem to be of sedimentary origin and at other times blend into them. The porphyritic rocks sometimes appear as bunches in the dark compact schists. Several dikes of the "eye" gneiss were noted which had flesh-colored feldspar crystals 2 to 3 in. long and which were sharply defined from the inclosing rocks, while others which were very similar



in character, but not so coarse, seemed to blend by transitions through types in which the feldspar was more corroded to those in which it appeared as stringy masses, and finally into a typical hornblende schist. The bunchy feldspathic aggregates blending into bands undoubtedly represent crystals which had become softened by partial re-fusion and then been drawn out in the moving magma. This character is very finely shown on the Piru in the vicinity of the Castac Mine. It would seem probable that the greater portion of these hornblende and mica schists formed originally a portion of an eruptive mass.

The most easterly mine in this belt is the Castac, on the south bank of the Piru. The vein is inclosed in the crystalline schists and has a northwest and southeast course. Numerous small quartz veins occur in the schists on the southern slope of Frazer Mountain. The veins are either in a fine-grained variety of the "eye" gneiss, as, for example, the Frazer, or on the contact of coarse dikes of a flesh-colored variety with narrow bands of schists, as on the southwestern slope of the mountain, where are situated the Bunker Hill, Fairview, and White Mule mines. The mineral deposits of the San Emedio Cañon have an entirely different character.

The region about Frazer Mountain is remarkable for the number and variety of the volcanic rocks. A banded liparite appears on the northern slope of the Sierra Libre range. At Gorman Station is an outcrop of a dark basaltic rock. Near the Frazer Mine is a dike of fine-grained liparite, while on the northern slope of the mountain are coarse liparites with more basic amygdaloidal varieties. On the southern slope of Mount Pinos are extensive areas of a variety of lavas, mostly basic. The San Emedio range has been the scene of great strain and faulting along an east and west line, not only in Tertiary times, as indicated by the volcanic rocks, but also quite recently. The effects produced by a great earthquake, probably that of 1872, can be traced a number of miles along the stage road from Gorman Station to Antelope Valley, where large depressions still exist. The fissure extended west across the San Emedio Cañon for an unknown distance. Abundant springs gush out along this fault line; in fact, it can be traced by them.

Limestone in a highly crystalline condition outcrops in the granite near Gorman Station. Numerous but detached areas appear in a westerly direction from this point, being especially prominent in the range north of Cuddy's Valley, and in the San Emedio Cañon. Near Gorman Station, as well as in a branch of San Emedio Cañon, iron ores occur in conjunction with the limestone.

The northern portion of Mount Pinos consists of mica and hornblende schists, dipping at a high angle to the south. Granite, however, appears some distance down the San Emedio Cañon where it rises in peaks 6,000 ft. high. The San Emedio antimony mines are located on a high granite mountain on the east side of the cañon. A short distance below the old works the crystalline rocks are succeeded by the Eocene-Tertiary, which consists to a great extent of sandstone, rising in cliffs nearly 1,000 ft. high, and exposing the stratification very clearly.

A ridge of crystalline rocks extends northwestward from Mount Pinos for a number of miles, when it sinks beneath the Tertiary, thus terminating the exposed portion of the crystalline axis, which, without doubt, continues still farther underneath the clays and sandstones to connect with the San Luis range of granitic rocks. The Cuyama River for nearly

a hundred miles down from its source may be said in a general way to divide the Miocene from the Chico; the Tertiary extending northwest from the San Emedio region, to form the parallel ranges bounding the Carisa Plain, while the high ranges in the northern part of Ventura County about the head of the Sespe and San Buenaventura rivers, extending into central Santa Barbara County, consist chiefly of the Chico, with occasional patches of overlying Miocene. About the very head of the Cuyama River, north and northeast of Ozena Post Office, the Miocene clays and sandstones are impregnated to a remarkable degree with alkalis, the dry bed of the streams being almost perfectly white in many places. The upper Sespe flows from west to east between high ranges of unaltered rock, which, judging from the few fossil remains found, belong to the Chico. The highest portion of the range on the north, separating the Sespe from the Cuyama, is called Pine Mountain, having an elevation of about 6,000 ft. The shales and sandstone of this range lie quite flat, dipping slightly to the north. They form the southern half of a synclinal fold, which is very clearly shown in the region about the head of Santa Barbara Cañon. The strike is nearly east and west. A few poorly preserved fossils were collected on the northern slope of Pine Mountain. The following species were made out: *Actæonella oviformis*, Gabb; *Dentalium stamineum*, Gabb; *Fusus remondi*, Gabb; *Turritella* sp.; *Neverita globosa*, Gabb; *Nassa cretacea* (?). This fauna is thus seen to indicate the upper Chico or possibly Tejon. Stratigraphically these beds are from the upper portion of the synclinal fold before mentioned.

Pine Mountain has on its southern slope a strip of Tertiary sandstones and clays which are exposed in bold cliffs facing the Sespe. They dip to the northeast at a small angle, and near the point where the Matillija trail crosses rise fully 1,000 ft. above the valley. They are characterized by an abundance of Miocene fossils. Although no actual contact was observed here with the underlying Chico, everything points to a non-conformity.

The range south of the Sespe rises nearly as high as that on the north, and consists of gray sandstone, generally thin-bedded, and black shale; the strike is a little north of west, and dip either south or north at a high angle. Descending the south side of the range, the Matillija Cañon was followed down to the hot springs, where it opens out to the Santa Ana Valley. The few fossils found indicated the upper portion of the Chico, and were determined as follows: *Fusus martinez*, Gabb; *Meretrix horni*, Gabb; *Crassitella grandis*, Gabb. The shales and sandstone are uniform in character to the mouth of the cañon, but the dip and strike are very irregular, and show a great amount of crushing. The rocks are very clearly exposed in the sides of the cañon, the cliffs being in places fully 1,500 ft. high. The whole width of the Chico exposed in this section must be as much as 12 miles, but so irregular is the dip that no estimate of the thickness can be given. The Santa Ana Valley seems to form the southern boundary of this series. From this point the Miocene extends south and west to the coast. This region is remarkable for the entire absence of eruptives of any kind. Although lavas were reported by the Pacific Railroad Survey, no traces of any were seen during the present investigation.

In a westerly direction, that is, in the eastern part of Santa Barbara County, these ranges unite to form an elevated and very rugged region

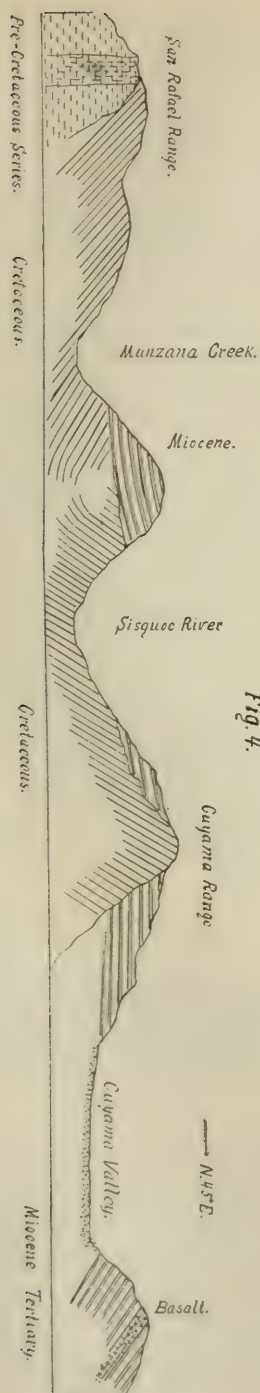


Fig. 4.

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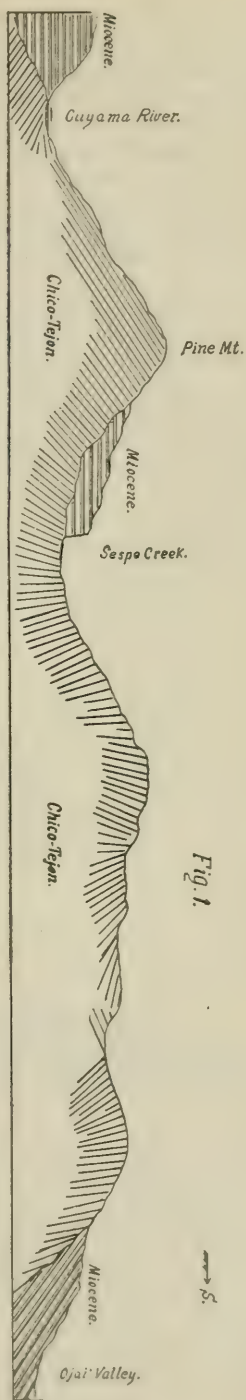


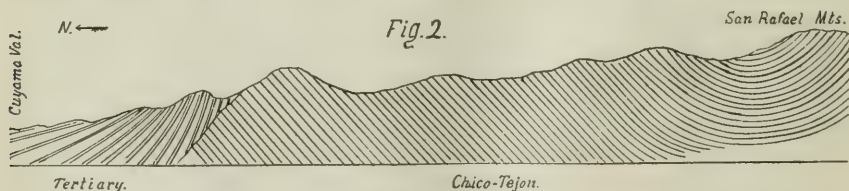
Fig. 1.

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of which very little is known. As far as our observations were carried it seemed to consist of the Chico overlaid in places by the Miocene. Streams flow from this watershed to every point of the compass, giving rise to the Sespe, the Sisquoc, the Santa Ynez, and important tributaries of the Cuyama. The three important ranges of Santa Barbara County may also be said to start here. These are the Cuyama, the San Rafael, and the Santa Ynez. The Santa Ynez is formed, as far as is known, of Miocene rocks exclusively; the other two of pre-Cretaceous, Cretaceous, and Tertiary. The highest peak to be found in Santa Barbara County rises about 7,000 ft., forming a sort of semi-circle about the head of the Sisquoc.

Santa Barbara Cañon, which opens north to the Cuyama River, shows a good cross-section of that portion of the mountains. Tertiary rocks appear for about 5 miles up the cañon. The beds consist, at the base, of the usual clays, richly impregnated with gypsum. Higher up there is red sandstone, dipping but slightly to the north, that is followed by soft, heavy-bedded sandstone of a light-yellow color. The latter are inclined at a steep angle and rest on the Chico, which consists of dark shale and thin-bedded sandstone, dipping about  $70^{\circ}$  to the southwest. In appearance these rocks are very similar to those on the Matillija. From this point to the head of the cañon, a distance of about 8 miles, the Chico continues, dipping  $60^{\circ}$  to  $80^{\circ}$  to the southwest, and strike N.  $60^{\circ}$  to  $70^{\circ}$  W. As the divide is approached the sandstones assume a tawny-yellow color, and contain dark concretions similar to those elsewhere in this series. Although no fossils were found in the cañon, the strata appear to be the direct continuation and of the same age as those crossed on the Matillija trail. On the summit opposite the head of Mono Cañon a reversion of the dip takes place, and the high mountains on the head of the Sisquoc and along the upper Mono Cañon repeat, only in opposite order, the strata passed over in Santa Barbara Cañon. The thickness of this series as shown in the latter cañon is enormous. The dip is quite uniform, and unless the strata are repeated by faulting, of which no traces were observed, it must be 25,000 ft. *Fig. 2* is a section in this cañon.

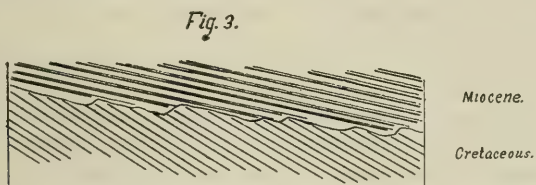


The Cuyama range was crossed about 15 miles west of Santa Barbara Cañon, opposite the Cuyama ranch house. At the point where the trail crosses there is a depression in the Chico, and the light-yellow sandstones so characteristic of the Miocene in this section extend from the eastern side over the summit a short distance. The older gray sandstones and shales appear in the higher portions of the range both north and south. The Miocene sandstones are heavy-bedded, and seem to dip away from the axis of the range at a small angle. The sandstone weathers out in great knobs, and in a cañon north of Montgomery's Potrero forms a very extensive series of high-terraced cliffs, known as

the Painted Rocks. Five terraces appear, each fully 100 ft. high. The rocks exposed in the cañon of the Sisquoc for many miles belong to the Chico, judging from a number of specimens obtained from the cañon a little above the point where the Jackson trail strikes it. The following forms were determined: *Inoceramus*; *Baculites chicoensis*, Trask; *Bulla horni*, Gabb; *Cinulia obliqua*, Gabb; *Pectunculus veatchi*, Gabb; *Meekia sella*, Gabb.

While dark sandstone and shale form the prevailing rocks, yet there are very extensive beds of boulder conglomerate. The boulders are chiefly of the granite type, and sometimes are as much as 3 ft. in diameter. A southerly dip predominates, though that, as well as the strike, is very irregular.

A range of rugged mountains lies south of the Sisquoc between it and the Manzanita. The higher portions of these mountains are capped by Miocene sandstones, but slightly disturbed and contrasting strongly with the underlying Cretaceous. As the cañon is ascended, the Cretaceous gradually sinks and the light-yellow sandstones appear in bold bluffs along the water's edge near where the stream divides. The Tertiary overlies the Cretaceous unconformably, a fact which was illustrated by an excellent exposure on the Sisquoc, where the older shales and sandstone dip south about  $30^{\circ}$  and are overlaid by the Tertiary sandstone, which rests on their irregularly eroded surface with a considerably smaller dip. Iron springs are numerous along the contact. *Fig. 3* illustrates the non-conformity.



The three ranges, the Cuyama, the San Rafael, and the intervening one, have each an elevation of about 4,000 ft. along a section between the town of Santa Ynez and the Cuyama ranch house. The geology of this section is illustrated by *Fig. 4*.

The Cuyama Valley has a length of 35 miles, gradually narrowing toward the western end, where the river turns to the southwest and cuts across the Cuyama range. On the north of the valley, and separating it from the Carisa Plain, is a range of high and barren Tertiary hills formed of gypsum-bearing clays and soft sandstones. These rise quite abruptly from the valley, exposing well their stratification. The hills were explored for a dike which was reported to carry silver, and as a result the occurrence of a most interesting eruptive mass was brought to light. An immense dike of the diabase type and rich in analcite was found to extend for several miles in a northerly course on the western slope. At the southern end the width is at least 1,500 ft., narrowing somewhat to the north. The great mass of the rock is so completely decomposed as to give the same contour to the hills as the soft Tertiary beds, and if it were not for the presence of many small but harder dikes traversing it, and for the rather precipitous croppings in the narrow

cañons, its presence would hardly be suspected. The substance from which the analcite has been derived is not certainly known, but it is probably nepheline, or some related mineral. The susceptibility to decay and the disintegrated condition of the whole mass must be due to some mineral of this class. Dikes of somewhat different composition and structure cut through the decomposed portion in every direction. They vary in width from a few inches to nearly 20 ft., and are quite hard and fresh. The analcite is present in some of these dikes in clear glassy grains fully half an inch in diameter. In places they are undergoing decomposition to radial zeolites. The other components of the rock are feldspar (plagioclase), augite, and ilmenite (titanic iron).

The Tertiary has been thrown into a vertical position adjoining the dike and very considerably metamorphosed. This metamorphism consists of a hardening of the clays and their transformation to dark shales, while the sandstone and calcareous strata have been partially recrystallized. A great mass of Tertiary shales has been inclosed in the eruptive mass, as shown in the side of one of the cañons. Excellent specimens, showing large cleavable crystals of diallage and grains of analcite, were obtained from one of the dikes about 15 ft. wide. The large dikes are, as a rule, coarse, but show little difference as regards this character between the centers and the edges.

On the summit of this range, between the Cuyama ranch house and the Carisa Plain, is a series of volcanic beds, probably basalt, interstratified with the Tertiary clays. They vary in thickness from 10 to 100 ft., and extend along the crest for several miles. Judging from the float, another outcrop is to be found in the same line of hills opposite the lower end of the Cuyama Valley.

Toward the lower end of the Cuyama Valley horizontally bedded Miocene hills appear, in places rich in fossil oysters and pectens. The Chico outcrops from underneath these beds, inclined at a considerable angle. Both north and south of the valley the Tertiary itself is considerably inclined. For some distance above the main cañon, and north of the point where it turns to enter the mountains, there are very extensive conglomerates, probably nearly 2,000 ft. in thickness. They form high mountains in the southern part of San Luis Obispo County, being really a continuation of the Cuyama range, only under another name. Continuing in a northwesterly direction, this range becomes still higher until divided by the San Luis Valley, at the upper end of which the Salinas River rises. The northern arm unites with and overlies the southern portion of the San Luis range of granitic rocks. The southern arm forms the watershed between the Salinas and the Alamo, the Arroyo Grande, and the Corral de Piedra creeks, which empty directly into the ocean. In its northwest prolongation this range forms the Santa Lucia.

The Cuyama River turns to the southwest several miles below where it enters the cañon, and for a distance of 20 miles cuts through the mountains at right angles to the strike of the rocks, giving an excellent section of all the formations represented in Santa Barbara County except the Pliocene. For several miles before turning to the southwest the river is bordered by heavy-bedded conglomerates, dipping southwest at about 30°. At the very point where the course changes, shales and dark sandstones appear underlying and nearly level. There is an appearance of non-conformity, but both series probably belong to the Cretaceous. The presence of pebbles similar to the underlying sandstone in

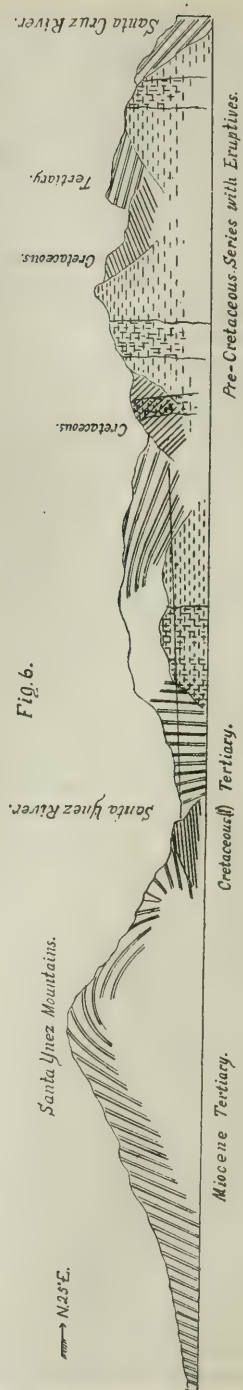
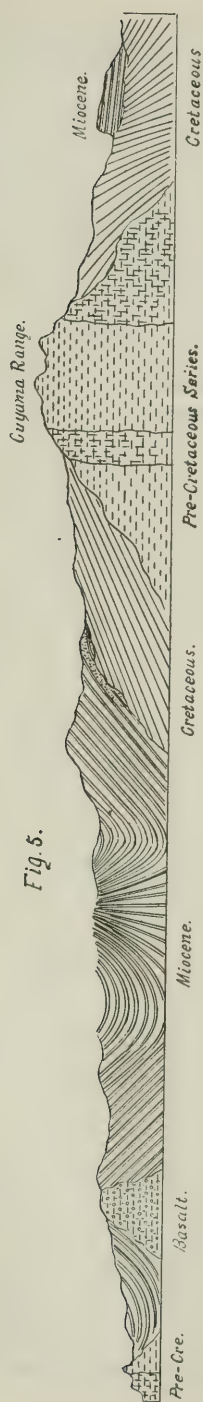


the conglomerate near its base, and their absence at a greater distance, favor this view. The shales and sandstone present a very regular bedding as exposed down the cañon. They finally become nearly vertical, then for some distance present a dip of  $30^{\circ}$  to  $40^{\circ}$  to the north, and are last seen resting against an older and greatly altered crystalline rock. Higher up on the sides of the cañon they rest on this ancient eruptive.

A mile back from the main cañon, on the south side and about 700 ft. above, is a remnant of the Miocene overlying the Cretaceous. The strata dip at a gentle angle to the northeast, and consist of light-colored, chalky, or calcareous rocks above, containing scattered and imperfect pectens, and at the bottom soft clays. There can be no doubt that these beds are unconformable on the Cretaceous, though no actual contact was observed.

The series underlying the Cretaceous appears for about 5 miles along the cañon, and consists of rocks of a greatly varied character. The first of the older, or pre-Cretaceous series, is a dark-green eruptive, seamed with epidote and so changed that the individual constituents cannot be made out with the unaided eye. This eruptive is succeeded down the cañon by other dark, fine-grained rocks, also evidently eruptive in origin. Below the eruptives on the rugged walls of the cañon are shown hard sandstones containing quartz veins, jasper, and serpentine. The last exposure consists of greatly contorted and crushed shales and sandstones filled with a network of minute quartz veins. The contact with the Cretaceous on the western border of the older rocks was not observed, but it appears a short distance away and continues for 2 miles down the cañon. The rocks of the latter formation consist of dark shales and gray sandstone dipping southwest at varying angles. They show no crushing or quartz-veining. The rest of the cañon to its mouth where it debouches on the Santa Maria Plain, is bordered by mountains of Miocene rocks, much disturbed and inclined at high angles. The contact with the Cretaceous was not plain, but it seems to be indicated by a conglomerate wholly unconsolidated, and which is followed a short distance down the cañon by the usual soft clays and sandstones of the Miocene. The conglomerate overlies the Cretaceous unconformably, has a distinctly reddish tint, and consists of angular sandstone fragments and well-worn pebbles. *Fig. 5* is a section along the road from Santa Maria to the Cuyama Valley, following the cañon most of the distance.

The geology of the region about the head of the Santa Ynez River is very complex, and though many new and interesting facts were noted, yet time did not permit of detailed work sufficient to illustrate the structure clearly or the relation of the various formations to each other. It was found, however, that there were extensive areas of the Chico, the Miocene, and smaller ones of the Lower Cretaceous. There can be no doubt that the main portion of the Santa Ynez range is Miocene, with a general anticlinal structure, well known in the San Marcos Pass. The center of the anticlinal is not generally the highest portion of the range, but lies on the eastern slope. The normal type of anticlinal structure is also masked by an east and west compression, producing features, however, of secondary importance. As viewed from the south at various points the range consists of heavy-bedded sandstone, dipping at a high angle to the south. The foothills and plain bordering the ocean, consisting of a higher portion of the same series, are mostly soft shales and clays,



gradually becoming more flat as the ocean is approached. At the western end, in the vicinity of Point Arguello, no anticlinal structure is apparent, but steeply inclined and broken strata. Asphaltum is found in many places near the sea from Point Arguello to Ventura County. Antisell, in the report of the Pacific Railroad Survey, reported trachytic axes from many points in this range, but examination made it evident that he mistook areas in which the oil or asphaltum had been burned for eruptive bodies. There are numerous such areas in the vicinity of asphaltum deposits where the rock has been baked and partly fused.

The Santa Ynez River in its upper course runs close to the northern base of the Santa Ynez Mountains. On the north of the river rise quite abruptly the foothills of the San Rafael range. There is thus formed a rugged and narrow cañon where the formations are well shown. Several large cañons which come in from the north also give excellent opportunities for study. Beginning in Oso Cañon and extending in a slightly northwest direction for about 25 miles is an almost buried ridge of the pre-Cretaceous series. Nearly all the main tributary cañons of the Santa Ynez on the north cut across this ridge, which at its western end extends nearly to the summit of the San Rafael Mountains. As in the cañon of the Cuyama, this series consists of argillaceous rocks and sandstone greatly crushed, stratification being often nearly or quite obliterated, while silicification is more or less pronounced. Red jasper is the most striking rock present, and covers a considerable area. Serpentine, dark, fine-grained intrusives, and glaucophane schist also appear. On the sides of the older area are beds of black shale in which several intrusions of serpentine appear. Everything points to the fact that the serpentines all date from a time prior to that represented by the Chico. If this is a fact, then all rocks intruded by it must be at least as old as the Lower Cretaceous. Fossils indicating the Chico, or possibly the Lower Tejon, were found in strata apparently overlying those intruded by serpentine. The Miocene is very extensively developed. It consists of the bituminous slate series and sandstone, in some places but slightly disturbed, in others folded in with the Cretaceous. A great amount of faulting has taken place on both sides of this pre-Cretaceous axis, rendering the structural relations exceedingly difficult of elucidation. The notes here given make no pretense of accuracy in detail, but are intended to indicate what may be looked for. The scarcity of fossils in all the formations adds greatly to the difficulty.

The serpentine appears in places for 10 miles to the east of the last outcrop of the pre-Cretaceous axis. It is inclosed in black shale and limestone. In two spots it has been metamorphosed by mineral solutions with the deposit of cinnabar. Many years ago each of these localities was worked for that metal. At the lower mine, the Los Prietos, the river has cut through great cliffs of red gossan, which is inclosed in unaltered serpentine. In contact with the serpentine on the south is limestone; on the north, shale. The dip of both walls is nearly vertical at the contact. The appearances indicate that the north wall has been bent down toward the vein, while the south has been bent up. A half mile above, the shale, with thin beds of sandstone, appears in nearly vertical cliffs fully 1,000 ft. high, facing the river. In this great cliff, as well as for several miles up the river, whose general course follows the serpentine, the strata are crushed and broken. Several fossils were obtained from these rocks. They were determined as follows: *Turritella*



*veatchi*, Gabb; *Olivella mathewsoni*, Gabb; *Scalaria mathewsoni*, Gabb; *Axinea veatchi*, Gabb.

Four miles up the river is the Santa Cruz Mine, where the serpentine, inclosed in black shale, outcrops nearly 600 ft. above the bottom of the valley. In Mono Cañon, a tributary from the north, a little to the east of the mine there is no appearance of the Chico. The rocks for a number of miles consist of the bituminous slate series of the Miocene. Between the two mines the river has eroded a channel across the strike of a body of Miocene sandstone exposing a perfect anticlinal arch. Terraces of boulders and gravel appear nearly 500 ft. above the river at the Santa Cruz Mine.

A little above the point where the stage road over the San Marcos Pass strikes the river is another small outcrop of shales, supposed to be Cretaceous.

*Fig. 6* is a section across the Santa Ynez range and through Red Rock Cañon. It is given particularly to illustrate the complicated structure shown in the latter cañon. In the lower portion of the cañon there are exposed three series of rocks: The pre-Cretaceous at the bottom, consisting of glaucophane schist and other altered eruptives, sandstone, and shale; resting on these are flinty beds of unknown age, and apparently unconformable, while on the top is the Miocene, forming an anticlinal over the submerged ridge of older rocks. These older rocks are well shown at the head of the cañon, where there is an immense outcrop of banded jasper, known as the Red Rock, rising vertically 300 ft. In direction of strike the jasper crops prominently to the east in Oso Cañon and to the west in many places for a number of miles. The older series contains in addition to jasper, sandstone, shale, glaucophane schist, serpentine, and other decomposed eruptives.

On both sides of the ridge between Red Rock Cañon and the Santa Cruz River are small exposures of black shale and thin-bedded sandstone, not greatly crushed, and very closely resembling the Lower Cretaceous, as it is generally known through the State. These rocks dip toward the center of the hill, which consists of the pre-Cretaceous. On the south the shales are exposed in a high cliff, and are full of nodular calcareous concretions. A dike of serpentine has been intruded into these shales conformably to the strike and dip. This is beautifully shown on the face of the cliff. Although no fossils were found, it seems highly probable that these unaltered strata belong to the Lower Cretaceous. The hills at the head of the cañon are capped by a Tertiary sandstone dipping north at a small angle. From the divide the deep cañon of the Santa Cruz is seen to head in very rugged mountains nearly 7,000 ft. high. Rocks apparently of Cretaceous age outcrop also in Oso Cañon. They dip nearly vertical, and are overlaid at the head of the cañon by a great thickness of Tertiary strata.

The Cretaceous and older rocks are again well exposed in Cachuma Cañon, which heads in the San Rafael Mountains north of the town of Santa Ynez. On the south the Tertiary clays dip into the range resting on the pre-Cretaceous series, which consists of jasper, sandstone, and shale with dikes of serpentine. The cañon cuts through this ridge of older rocks, then turns to the northwest, having eroded its channel along the contact between the Cretaceous and the basement rocks. The Cretaceous consists of black shales with some beds of sandstone, resting nearly vertically either against the basement rocks or the serpentine,

which has been intruded on the contact. Toward the head of the cañon the shales are filled with calcareous nodules resembling those in Red Rock Cañon. These rocks form the lowest part of the Cretaceous at this point, and may represent the Knoxville, as there is not much doubt about the intrusion of the serpentine into them. One of the tributaries of the Manzana heads opposite the head of Cachuma Cañon and flows northeasterly nearly at right angles to the strike. Following down this stream shales and sandstone are the only rocks to be seen for 3 miles. The dip is less than at the base of the series, being  $50^{\circ}$  to  $60^{\circ}$  northeast. About 2 miles down the cañon an ammonite was found, but in too bad a state of preservation to indicate anything more than the Cretaceous. These beds extend about half way from the divide to the Manzana, where they are replaced by vast beds of conglomerate formed of very smoothly rounded pebbles. The conglomerate has interbedded with it thin strata of shale and sandstone, and is undoubtedly a part of the Cretaceous. However, it dips considerably less than the underlying shales, but the exposures were not good enough to decide with certainty if an unconformity existed. The shales and sandstones have a thickness of as much as 8,000 ft., and the conglomerate several thousand more. The latter outcrop along the Manzana, and form the basal portions of the high mountains between it and the Sisquoc, the upper portions of which are formed of Miocene sandstone. In the upper part of Brown's Cañon, which heads several miles to the north of the Cachuma and empties into the Manzana, there are quite extensive dikes of basalt and serpentine intruded in the Cretaceous. The basalt is quite fresh and presents a variety of characters. It is present solely in the form of great dikes, and is said to extend several miles to the northwest. The crystalline rocks along this part of the San Rafael range are varied and of considerable interest.

The western half of Santa Barbara County, with the exception of a few small areas, is formed of middle or late Tertiary; the ranges of mountains between the parallel valleys which open to the northwest being Miocene, while the Pliocene is probably represented along the low hills bordering the level Quaternary valleys. The presence of large bodies of asphaltum and bituminous rock is very characteristic of the Miocene over much of this area.

The Santa Ynez Valley narrows about 10 miles below the old mission, and the river flows between Miocene hills until the Lompoc Valley is reached. On the south side of the river, where it leaves the Santa Ynez Valley, is a high, precipitous outcrop of volcanic tufa, and in the Miocene beds resting upon it are boulders of a black basalt. Opposite Buell's ranch a cañon comes in from the Santa Ynez Mountains. In this cañon shales and sandstone of undoubted Cretaceous age show a width of more than a mile. They form an east and west line of hills bordering the Santa Ynez River for several miles. The shale alternates with thin layers of a dark sandstone and nodular calcareous strata similar to those seen in the supposed Lower Cretaceous in other portions of the county. The strata have undergone considerable crushing, and are in various positions; generally, however, they are quite flat, and toward the south have a southerly dip. A mile and a half up the cañon they are replaced by tawny, heavy-bedded sandstone, often showing no stratification. This sandstone forms all the higher country toward the Santa Ynez Mountains, and dips gently to the south and southwest. It contains poorly preserved specimens of *Pectens* and *Ostreas*. In a side

cañon which comes in from the west there is an excellent section showing the contact between the buff-colored sandstone and the dark shales. Both formations dip to the west, the sandstone  $20^{\circ}$  and the shale  $37^{\circ}$ . The non-conformity is very evident. The Cretaceous shales appear in only a few places along the road from the old mission to Gaviota, being almost completely covered by the Miocene. Heavy beds of boulders of a serpentinous gabbro cap the hills west of the road about 3 miles south of the river. The large boulders of coarsely crystalline gabbro, generally not much worn, are imbedded in a matrix of sand and small sandstone pebbles. It is not certain whether this is an old beach line or river bed. Associated with the large boulders are small ones of jasper.

The Santa Ynez range at this point has a bold northern escarpment, rising over 1,500 ft. very abruptly. At the crossing of the river near the mission the sandstone dips northerly, while the high portion of the range dips to the south. There is here a rude anticlinal with an axis of Cretaceous rocks. The axis was not traced up the river on the south side, but it is probable that it appears in several places.

A short distance north of Lompoc Landing a reef of gabbro and serpentine extends out into the ocean for several miles.

Point Sal shows a bold face to the south and west. It consists of serpentine and other basic rocks. These extend for several miles, and are capped by Miocene clays and sandstone. The latter dip away from the crystalline axis, and are finely shown in the vicinity of the gypsum mines. Serpentine proper forms only a part of the crystalline rock, but is mixed in the most confused manner with gabbro and pyroxenic rocks, coarse to fine-grained, and quite variable as regards the relative abundance of the different components. Much of the serpentine is very fine-grained, and has inclosed bunches of all shapes and sizes of gabbro, and is, in addition, cut by dikes of the same. At times the boundaries between the two are sharp, at others there is a blending.

Dark, fine-grained eruptives outcrop through the Miocene on the summit of the ridge where the road to Santa Maria crosses it.

Another outcrop of the pre-Cretaceous series is to be seen on the Suey grant, north of the Santa Maria River. The formation seems to be the continuation of the ridge of rocks of the same age in the central part of Santa Barbara County. It consists of glaucophane schists and hard sandstone, and contains dikes of serpentine.

A series of ancient lavas begins on the ridge north of Fugler's Point, and extends in a northwest direction many miles, cropping on the western slope of the hills which border the Nipomo ranch on the north. Where the Cuyama road crosses this ridge the lava is a dark, fine-grained basalt. On the Nipomo ranch it has been much silicified by the action of hot springs now extinct. Agate-like chalcedonic nodules are abundant along the base of the hills for several miles. The basalt disappears 3 miles north of Nipomo, and a liparite much decomposed outcrops in places along the side of the valley nearly as far as Arroyo Grande. In places it is with difficulty distinguished from the Miocene sandstone. The line of ancient silicious springs was traced as far as Arroyo Grande. The silicification is not confined to the volcano rock, but appears also in the Miocene. The springs probably indicate an important fissure system, which may be traced northwest to Morro Bay by the numerous bodies of acid eruptives. Near Arroyo Grande the bituminous slate series has been mineralized with the deposit of iron pyrites, leading to a useless



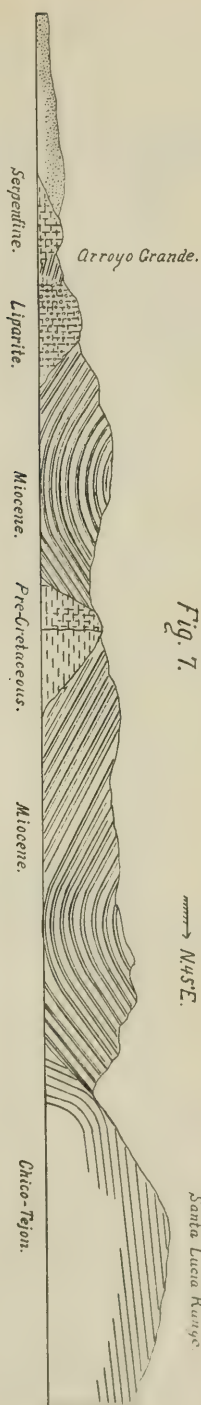


Fig. 7.

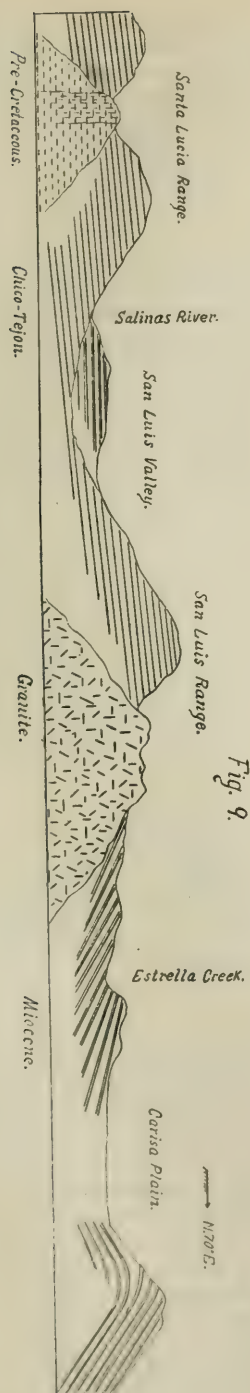


Fig. 9.

search for the precious metals. A small outcrop of serpentine appears south of Arroyo Grande near Los Barros Creek. As we proceed up the Arroyo Grande it is noticed that the Miocene forms a synclinal, dipping from the liparite on the southwest and on the north from serpentine, jasper, and sandstone, which outcrop on Tar Spring Creek. Before reaching the serpentine, high cliffs of a fine-grained liparite appear rising through the Miocene on the south bank of the creek. Liparite also outcrops on the Arroyo Grande about 5 miles above the mouth of Tar Spring Creek. Still farther up the Arroyo Grande it is found that for several miles the Miocene dips to the northeast, but before reaching Music it changes to the southwest, forming a synclinal, and consists of heavy beds of granitic sandrock bearing numerous fossils of the gigantic fossil *Ostrea*. Lower in the series these beds are replaced by argillaceous rocks, and on the Wasno, just over the divide from the head of the Arroyo Grande, the Miocene terminates in soft, white sandstone with very heavy bedding, and dipping southwest at an angle of  $45^{\circ}$ . A few feet away on the opposite side of the creek appeared the Chico, consisting of coarse-yellow to gray sandstone, conglomerates, and some shale. The beds dip at an angle of about  $80^{\circ}$  to the southwest. The actual contact was not observed. Fig. 7 is a section from the ocean up the Arroyo Grande to the summit of the Santa Lucia range.

The Chico forms the southern portion of the Santa Lucia range as far north as the Rinconada Quicksilver Mine. The main part of the series consists of coarse sandstone and conglomerate, dipping very regularly at a small angle to the southwest. The dip becomes greater as it disappears underneath the Miocene on the Wasno. North of the Rinconada Mine it is gradually replaced by the Miocene, and continues to form only the northeastern slope of the mountains facing the Santa Margarita Valley.

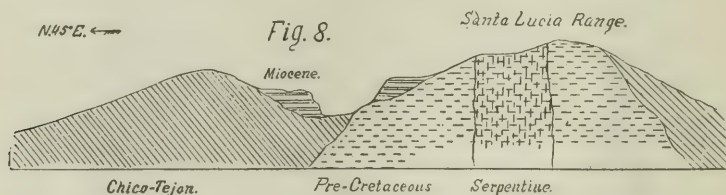
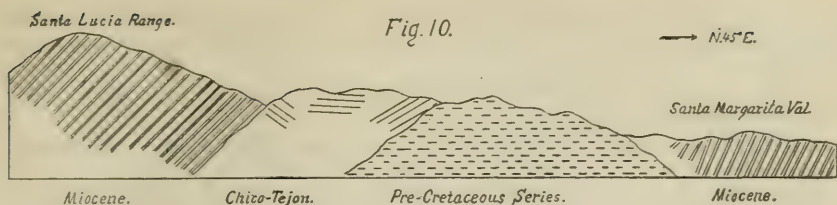


Fig. 8 shows a section of the Santa Lucia range near the Rinconada Mine. On the summit, southwest of Poso, where the trail crosses the Wasno, serpentine and the pre-Cretaceous sandstone and jasper outcrop in a long narrow exposure, with the Chico rising somewhat higher on either side. The younger series shows no disturbance. The older rocks become more prominent to the northwest, and at the Rinconada Mine are a mile wide, and consist largely of serpentine. Beyond this the older rocks become less prominent, occupying only a narrow strip through the foothills of the Santa Lucia range nearly to Santa Margarita Station. Four miles southwest of the town a deep cañon was examined, in which it appeared that the bituminous slate series (Miocene) had taken possession of the whole range, dipping  $60^{\circ}$  S.W., strike  $N. 40^{\circ}$  W. The slates show the best cleavage of any seen in the Tertiary. The upper foothills are formed of heavy-bedded sandstone and black shale, in which fossiliferous limestone nodules were found. All the fossils were of one species,



namely, *Venus lenticularis*, Gabb. This formation then belongs to the Chico. About 5 miles up the Santa Margarita Valley, on the same range, the following species were found: *Trigonia evansi*, Meek; *Axinea veatchi*, Gabb. These also indicate the Chico. Fig. 10 shows a cross-section of the range for 4 miles south of Santa Margarita.

South of Santa Margarita the pre-Cretaceous series consists of hard-jointed sandstone and jasper. Eastward in the bottom of the valley the Miocene shales again appear, dipping at a high angle to the southwest. As the valley is crossed in the direction of the Salinas River, coarse, loosely cemented sandstones, carrying *Ostrea titan*, replace the slate, and are in turn followed by granite near the river. The stratigraphical relation of the *Ostrea*-bearing sandstone to the bituminous slates is not certainly known; it would appear, however, from the section on the Arroyo Grande that the sandstones are below.

The granite occupies a considerable area of bushy hill country north of the river, and a few miles to the southeast rises in the high San Luis range. This range is bordered on the south between Santa Margarita and Poso by hills of white Miocene sandstone. The road from Poso to La Panza passes over granite nearly the whole of the distance. The summit of the range where the road crosses has an elevation of 2,700 ft. A large part of the crystalline rocks of this range contain much glassy feldspar, and some portions are porphyritic. Dikes of a fine-grained granite with flesh-tinted feldspar are abundant, particularly on the western slope. They vary from a few inches to many feet in width, ramifying in all directions in the coarse granite. Titanite in small yellow crystals is abundant in the main body of the granite. On the eastern slope, 6 miles from La Panza, a body of limestone is inclosed in the granite. The granite crosses the range diagonally, extending in a more easterly direction. At La Panza the outcrop is much narrower, and on the San Juan Creek, 4 miles below the Carisa ranch house, it disappears. The formation replacing the granite in the southern portion of the range is a series of conglomerates and sandstone of great thickness, and dipping southwest at a low angle. These connect with the Cuyama and Santa Lucia ranges at the head of the San Luis Valley, and are undoubtedly a portion of the Chico. These beds do not extend much east of the head of the San Juan Creek, though the exact demarcation between them and the Miocene has not been traced out. The Carisa Plain is bordered wholly by rocks of Tertiary age. The Mount Diablo range on the east has an elevation of 3,300 ft. at the Temblor Pass. In the pass a sort of anticlinal structure was noted, but the mass of the range at this point seems to be a monoclinical, with dip to the northeast. As La Panza is approached from the Carisa Plain the Tertiary assumes a northeast dip away from the granite, and is characterized by *Ostrea titan* and other Miocene fossils. The La Panza placers occur near the



junction of the Chico conglomerates with the granite, but whether the gold has been derived from them or from the granite has not yet been settled.

As far as is known, all the country drained by the lower San Juan is formed of middle and upper Tertiary.

*Fig. 9* gives a section across the Santa Lucia, San Juan, and Mount Diablo ranges, on a line with Poso and La Panza.

Returning now to the coast and working north from Arroyo Grande, we find another outcrop of trachyte a little north of Pismo. The region about Port Harford is rather an interesting one. A line of irregular Tertiary hills extends northwest from Arroyo Grande, lying west of the valley of San Luis Obispo. These are known in their western portion as the Buchon range. For several miles northwest from Arroyo Grande the Tertiary consists of soft sandrock impregnated with asphaltum over considerable areas. As exposed along the railroad to Port Harford, the strata consist of sandstone and bituminous slates in the form of a synclinal, dipping to the southwest from the older rocks west of Los Osos, and to the northeast from Port Harford. At the latter point the Tertiary appears resting on a complex of eruptives and crushed sandstone and jasper of the pre-Cretaceous series. From the dock to Whaler's Point the eruptives are very much decomposed. In a railroad cut a little to the east there appears a dike of somewhat fresher appearance, probably a diabase porphyryite. Irregular masses of serpentine appear in places crushed to a green clay.

The older series of sandstone, jasper, and slate, and intrusions of serpentine outcrop in small exposures on the western slope of the Santa Lucia and a little north of Arroyo Grande. Widening to the northwest this series forms the underlying rocks of the valley of San Luis Obispo as far as Morro Bay. It is also prominently developed in the hills on the eastern slope of the Buchon range. Serpentine forms the main crest of the Santa Lucia range for many miles to the northwest from the point where the old stage road crosses. The hills bordering the valley of San Luis Obispo on the west, from the point where the railroad to Port Harford cuts them, for several miles northward show large areas of serpentine. Large amounts of chromic iron have been taken from this region. The pre-Cretaceous rocks outcrop in the hills for 2 or 3 miles west of the serpentine near the head of Los Osos Creek. They consist of jasper, sandstone, and shale, with some intrusives of a dark, fine-grained character. *Fig. 11* represents a cross-section from Port Harford to the Salinas River, passing near the town of San Luis Obispo.

The line of buttes extending northwest from San Luis Obispo to Morro Bay is one of the most striking features in the topography of the county. The buttes consist of liparite, which is quite uniform in texture and composition. Two small buttes rise out of the valley southeast of the town of San Luis Obispo, but the lofty and precipitous ones all lie between the town and Morro Bay. The liparite rests on serpentine, as well as on the pre-Cretaceous series, thus showing it to be younger. It is quite possible that the material of each butte may have had a separate source, for now, at least, they are all separated from each other by depressions almost as low as the valley itself. The rock in these depressions belongs to the pre-Cretaceous series. The altitude of the main peaks varies from 1,500 to 2,000 ft., with a thickness of liparite of perhaps 1,000 ft. For several feet from the surface the rock

Fig. 11.

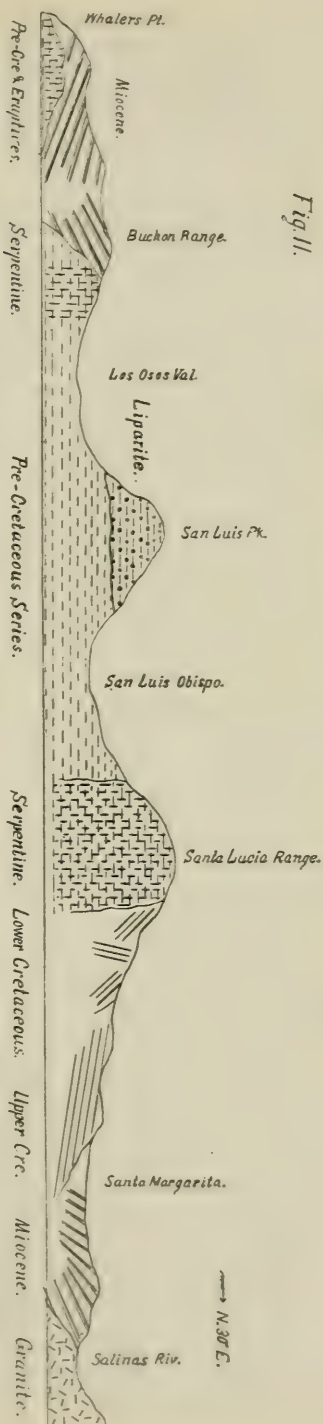
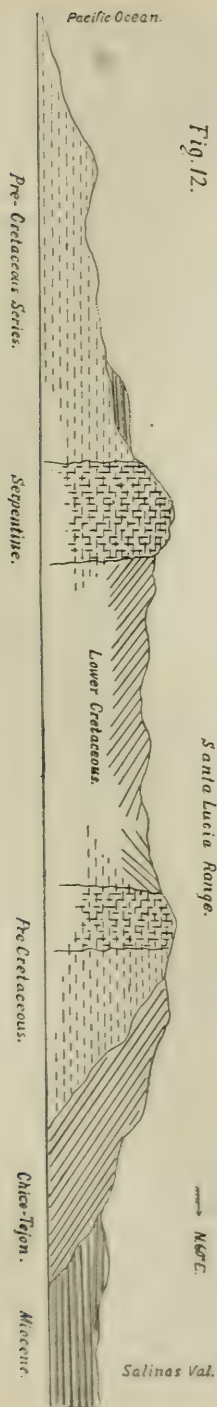


Fig. 12.



is discolored and decomposed, the original color being a gray. Morro Rock, the most northern of these buttes, is a bare mass rising about 600 ft. above the ocean. A quarry has been opened at the eastern end to supply material for the breakwater at Port Harford. Excellent specimens of fresh rock were obtained here, containing quite a sprinkling of small titanite crystals. The rock would make a good building-stone if it did not discolor on exposure.

The pass through which the road runs from San Luis Obispo to Santa Margarita divides the Santa Lucia geologically. On the southeast the Tertiary forms the crest of the range for several miles. On the northwest serpentine forms the crest and western slope. The eastern slope consists of black shale, judged to be Lower Cretaceous, because of the presence in it of a stratum rich in fossils of the genus *Aucella*. The black shale is seen first in the cañon southeast of the railroad tunnel. The tunnel cuts it for 600 ft., while the rest of the rock passed through is serpentine of varying character. The new railroad cuts have exposed some interesting tufa-like rocks of volcanic origin on the northern slope of the range. From this point down the creek to Santa Margarita the Chico sandstones outcrop. They continue to be very extensively developed on the northeastern slope of the range for many miles to the northwest. In fact, future examination showed that they were almost continuous to the head of the Arroyo Seco, in the western part of Monterey County. Five miles west of Santa Margarita the dark Cretaceous shales have a width of nearly a mile. On a trail which crosses this shale and leads up to the old Padre Mine, there is exposed a stratum at least 10 ft. thick, filled with rather poorly preserved specimens of the genus *Aucella*. The strata dip into the mountain at a small angle. The shales do not come into direct contact with the serpentine at this point, but are separated by a dike of diabase. They are considerably metamorphosed near the diabase, while a narrow stratum between the diabase and the serpentine is very much changed. The shales extend across the range on the head of the creek, and later investigations showed that they reached as far north as the head of Toro Creek, keeping near the summit of the range. The Cretaceous rocks outcrop in a direction at right angles to the strike across the creek below the old Padre Mine and part way up a high mountain on the northeast. In this direction strata are exposed which are lower in the formation, and are filled with calcareous nodules similar to those seen in the shale in several localities in Santa Barbara County. This mountain is quite precipitous to the south, and on the summit occur rocks of quite a different character. These rocks much resemble the Tertiary, though no fossils were found. Between the two formations a horizontal body of lava has been intruded in the form of a laccolite. The Cretaceous shales below are much broken for half a mile away, and for 200 ft. considerably baked, presenting bluish and greenish tints. The younger rocks above are also greatly broken, dipping in every direction, and the banded sandstone strata in near contact with the eruptive, show red, brown, and greenish tints. It seems probable that some of the shales directly below are also Tertiary. The lava is about 50 ft. thick in the center, thinning out at the extremities. It is quite porous on the edges and in narrow bands running horizontally through it, the pores being filled with calcite. Large crystals of feldspar appear in places in the dark, fine-grained rock.

The area of serpentine in the Santa Lucia, north of San Luis Obispo,



is very great, forming nearly the whole of the western slope of the range from the railroad tunnel northwest to Cayucos. It contains many chromic iron deposits, and is characterized by numerous bodies of diorite, generally in nodular form and from 2 to 3 ft. in diameter upwards.

The Miocene increases from small areas in the foothills of the range east of Morro, until back of Cayucos, near the summit of the range, where it is a mile and a half wide.

Toro Creek, which enters the ocean between Morro and Cayucos, was ascended to its head, and another complete section of the Santa Lucia range was made. For the first 6 miles up the creek the only rocks seen belonged to the pre-Cretaceous series, consisting chiefly of sandstone and jasper. At the base of the first high range, which consists of serpentine, there is a small area of Miocene. Northeast of the serpentine range, through which the stream has cut a narrow gorge, is a trough about 2 miles wide filled with black shale and a little sandstone, dipping northeast at a small angle. In one of the beds of coarse sandstone were found large, excellent specimens of *Aucella*. They occurred, perhaps, a thousand feet from the exposed base of the shales. Northeast of this Cretaceous valley is another range of serpentine, diorite, sandstone, and jasper. On the northeast slope rest heavy-bedded sandstones, probably of Chico age. These dip northeast at an angle of 40°. At the foot of the mountains the sandstone is followed by nearly horizontal Miocene strata, bituminous slates extending easterly to the Salinas River. Small patches of Miocene also appear near the summit of the eastern crest of the range just described. *Fig. 12* gives a section of the mountains at this point.

Between Templeton and Cayucos, a section farther north, no Lower Cretaceous strata appear, while Miocene shales are strongly developed on the west, extending up to and forming the crest of the range. The dip is to the southwest at a high angle. A dike of diabase, at present very much decomposed, has been intruded in them below the summit on the western slope. The summit of the mountains is broad here with a rolling surface, while here and there the pre-Cretaceous rocks project up through the Tertiary. The Chico extends up to the summit on the east. Everything points to the fact of the intrusion of the serpentine prior to the deposition of the Chico. The altitude of the range at the two cross-sections just given is about 1,400 ft.

With the exception of a small area of Miocene at Point San Simeon, and of Cretaceous south of Cambria, the rocks of the pre-Cretaceous series with decomposed eruptives form the coast-line for many miles north from Morro Bay. The greater portion of this older series consists of sandstone. It is not a very quartzose rock, and in decay produces a heavy soil. Beds of shale or slate appear interbedded with the sandstone. Jasper is not abundant along the coast, but in the higher ranges is very characteristic. There are several classes of eruptives. One has a greenish-gray or brownish tint, is fine-grained, and greatly decomposed. These rocks appear near Cayucos, between Cambria and San Simeon, and at various other points along the coast. There are numerous outcrops of serpentine near the coast, but the areas of greatest extent are found higher up in the range. Liparite quite similar to that at Morro Bay outcrops on Santa Rosa Creek north of Cambria, near the summit of the range 6 miles east of Cambria, on San Simeon Creek a mile from the ocean, and at several other places in the vicinity of

Cambria. It also forms a number of rugged peaks on the summit of the Santa Lucia. The highest of these peaks lies back of San Simeon, and is known as Pine Mountain. The liparite is undoubtedly the youngest of the eruptives in this region.

The strike of the pre-Cretaceous series is irregular—from Morro to San Simeon perhaps more often east and west, though sometimes parallel to the coast; dip generally slight. North of San Simeon the strike runs parallel to the coast and the dip is to the northeast at a small angle. Only a slight metamorphism is shown. The argillaceous rocks, which if not for the crushing undergone would be present as slate, are either represented by shale or clay. When the mechanical forces have been particularly strong the sandstone strata have been crushed and the shale, or rather clay, has been squeezed around the fragments so as to envelop them.

A belt of Miocene slates begins at Point San Simeon and extends northwest. It gradually passes away from the coast, forming low hills between the more mountainous portions of the Piedra Blanca grant and the ocean. It terminates in scattered patches 14 miles northwest of San Simeon, near San Corpojoro Creek. At San Simeon it dips oceanward at a high angle. Another cross-section of the mountains was made between Cambria and Paso Robles. Five miles east of Cambria the creek has cut through a dike of feldspar porphyry, leaving high cliffs on either side. Eight miles east the Miocene appears capping the hills. This strip of Tertiary continues northwest as far as the southern portion of the Piedra Blanca grant, and in a southeast direction connects with the great body of rocks of the same age on the summit back of Cayucos. The thickness of the strata is not great east of Cambria, and it seems strange that this section should have been selected as a suitable place to bore for oil. Eight miles east of Cambria, near Mr. Lehman's place, a well was put down nearly 700 ft., when a crystalline rock was encountered. The Tertiary rocks here are much disturbed by dikes of diabase, and it is probable that one of these was struck. This diabase is well exposed in a cañon near the Oceanic Quicksilver Mine. Four dikes of very greatly decomposed rock appear as intrusive in the Miocene. The strata have been thrown into a vertical position and considerably metamorphosed. Two of the dikes are each nearly 300 ft. wide. At the foot of the grade on the head of Santa Rosa Creek these dikes were encountered again. Here they are more decomposed still, with the development of a concentric shell structure. The nodules are, many of them, a foot in diameter, with very even, regular shells a quarter of an inch thick.

The usual series of shales, sandstone, and jasper forms the main portion of the Santa Lucia at this point. Patches of Tertiary extend up nearly to the summit on the southwest, while beginning only a short distance down on the northeast, the Chico sandstone and shale have a width of several miles. Below them is a lesser range of the older rocks, in which the Santa Cruz Quicksilver Mine is situated. East of this the Miocene slates underlie the whole country, except for a submerged axis of granite through the Salinas Valley. This granite axis is the prolongation of the crystalline axis of the San José range. It appears in places from Paso Robles northwestward along the divide between the Nacimiento and San Antonio rivers, finally joining with the more rugged portion of the Santa Lucia. The Miocene is almost undisturbed except on its very western



edge, as shown along the road from the Santa Cruz Quicksilver Mine to Paso Robles. Near the granite it changes to a loose quartzose sandrock. The course of the hidden granite axis can be traced by this sandrock.

A shaft was sunk for coal near the mouth of San Simeon Creek many years ago. Thin seams only were found and the work was given up. The coal is found in rocks which are supposed to belong to the pre-Cretaceous series, and it is the first instance which has come to the writer's attention of coal in that series of rocks in California. The low hills along Pico Creek are capped with a soft rock, probably Miocene. Near the head of the creek on the southeastern side of the Piedra Blanca grant there is a considerable thickness of a rather soft sandstone of unknown age, in which a small seam of coal has been found. The summit of Pine Mountain, as before stated, consists of liparite. Around its borders and apparently underlying it is a body of black shale, dipping to the northeast. The liparite is several hundred feet in thickness, and was once much more extensive. The underlying shale being soft, was worn rapidly away and the liparite has broken off in large masses, which strew the mountain sides and are piled in the cañons fully a mile away. On the grade leading up to the old sawmill specimens of *Aucella* have been picked up, and one is in the possession of the Mining Bureau. This gives the age of the shales as Lower Cretaceous. Serpentine apparently cuts the shale, but that could not be stated definitely, for no good contacts were seen. *Fig. 13* is a section of the Santa Lucia through Pine Mountain. From this point northward the Santa Lucia range has an elevation of fully 3,000 ft., and is very wild and rugged. North of San Simeon the range approaches the ocean, and north of San Corpojoro Creek but little agricultural land is to be found. The high mountains closely border the coast all the way from this point to Monterey, much of the distance rising very precipitously. But few small patches of land sufficiently level to be cultivated exist. Most of the mountain slopes facing the ocean are free from brush and are used as grazing land. A rough trail follows up the coast, and owing to the numerous deep cañons which it has to cross, is an exceedingly difficult and somewhat dangerous one to travel.

The pre-Cretaceous series, though it becomes more metamorphosed in portions of this lofty region, contains in general few intrusive masses. It is characterized by more or less silicification, and in the west central portion of the county (the Cruikshank District) the quartz veins are numerous and often rich in gold. However, it may be remarked that the gold-bearing quartz veins are not confined to this district, but from the center of Santa Barbara County northward through the whole length of the coast ranges, wherever this formation occurs there is more or less silicification, and at numerous points quartz veins carrying iron sulphides and traces of gold are to be found. In the cañon of Salmon Creek 3 miles above its mouth much prospecting has been carried on. The veins occur in a rather broken rock consisting of sandstone and shale. About half a mile south of these prospects, on the divide between the two forks of Salmon Creek, there is exposed the most remarkable bed of slates yet seen in this part of the coast ranges. The belt extends easterly, it is reported, for several miles. The dip is north away from a great serpentine ridge. The slates cleave well and have evidently escaped the effects of crushing which is so generally to be seen. In the shining black appearance and manner of weathering they closely



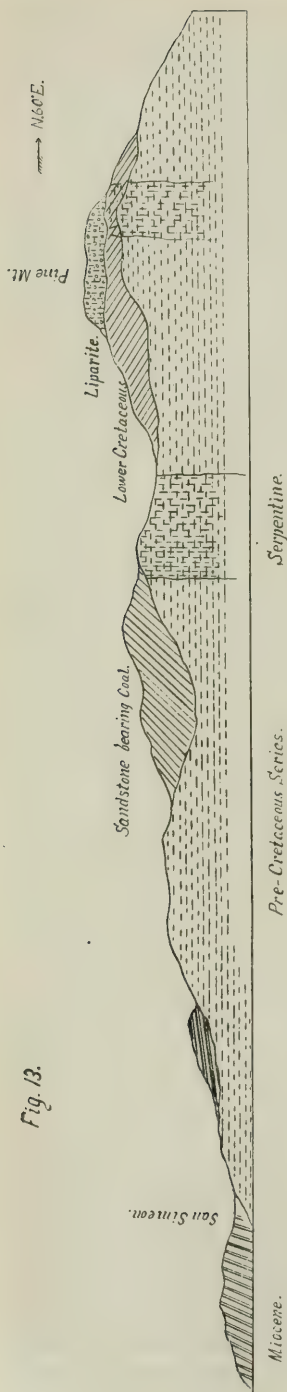
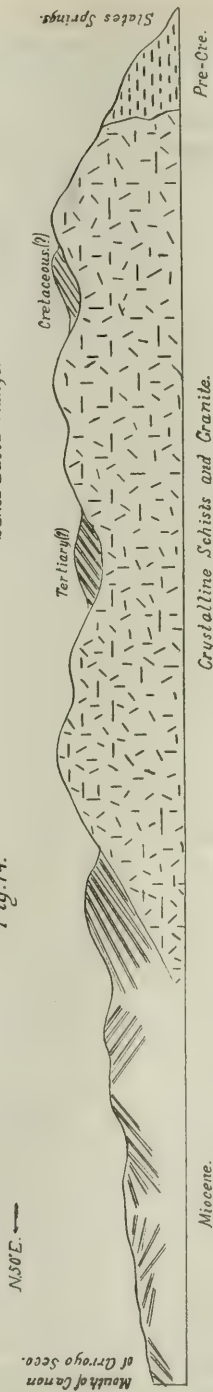


Fig. 14.

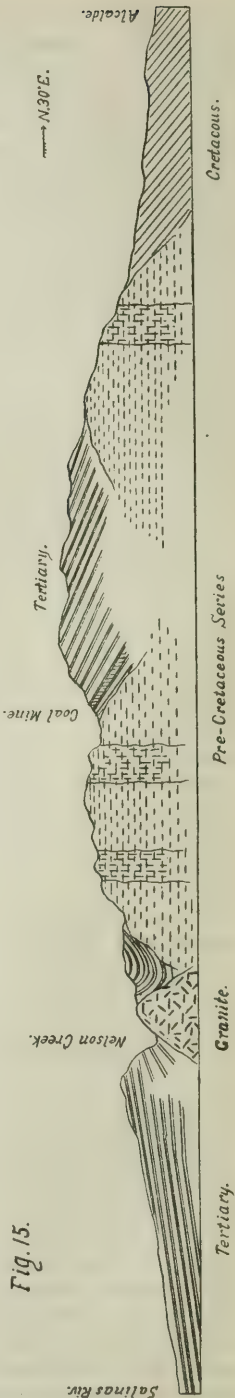
Santa Lucia Range.



Crystalline Schists and Granite.

Pre-Cre.

Fig. 15.



Granite.

Cretaceous.

resemble the Mariposa slates along the Mother Lode. Time did not permit of the search for fossils in this slate, but the chances for finding them here are much better than in most of the argillaceous rocks which have been so much distorted. The serpentine on the south contains many great bunch-like masses of diorite. Dark, fine-grained eruptives of various kinds outcrop in the cañon of Salmon Creek.

From Salmon Creek to the Cruikshank ranch the trail follows in the strike of the rocks, the shales and sandstones dipping generally to the northeast. The Cruikshank Mines lie at an altitude of about 2,700 ft., nearly on the summit of the range. No intrusions of any kind are to be found near the mines. The formation is sandstone chiefly, with some shale, and is very much broken. About 2 miles west of the mines the mountains rise somewhat higher and very precipitously from Point Gordo. Here is a considerable outcrop of a decomposed amygdaloidal lava, the region being known locally as the "Volcano." The lavas were traced for several miles to the southeast past the Cruikshank ranch. Two miles south of Pacific Valley a heavy body of serpentine forms a bold projection into the ocean. From Pacific Valley north to Mill Creek the trail follows near the ocean. The rocks are much metamorphosed and contorted, beautifully banded jasper appears, as well as semi-crystalline schists and sandstones, which are crumpled and filled with quartz veinlets in a manner quite similar to the rocks along the summit of the coast ranges in the western part of Tehama County. From the Cruikshank Mines the trail leads eastward to the Newhall ranch and Jolon. The pre-Cretaceous series has a width of 10 miles. The only eruptives seen on this trail were a dike of serpentine and a small one of glaucophane schist. Sandstone, shale, and jasper form the prevailing rocks. The last ridge, bordering the Nacimiento on the west, consists of the Chico dipping to the northeast. The basal portion rests on the pre-Cretaceous series. It is a coarse, feldspathic sandstone, followed upwards by shales, sandstone, and conglomerates. The sandstone dips under the valley of the Nacimiento and rises again on the eastern slope of the hills between it and the San Antonio River, dipping from these hills to the southwest. The river thus flows in a synclinal, which becomes very narrow at the upper end of the Newhall ranch, where the river issues from the cañon. This sandstone appears for several miles up the cañon, finally giving place to crystalline schists, which from this point northward form the main part of the Santa Lucia range. This is not, however, the most northerly point reached by this Cretaceous arm, for it forms much of the very rugged country on the head of the San Antonio, extending over the divide between it and the Arroyo Seco, and outcrops at least as far north as the point where the trail crosses the range from Slate's Hot Springs to the Arroyo Seco. Fossils are reported from this latter locality. These Chico beds are not known to extend over onto the ocean slope of the range.

The submerged granite ridge extending northwest from Paso Robles crops out on San Marcos Creek, 6 miles southwest of San Miguel, at several points between this locality and Pleyto, and again between the Newhall ranch and Jolon. Northeast of the latter point this granite axis rises to form with crystalline schists the main portion of the Santa Lucia range. The schists replace the granite north of the Newhall ranch, and with limestone form the high mountain about the head of the Nacimiento. Over the divide they extend about half way down to

the ocean, where they are replaced by rocks of the pre-Cretaceous series. As exposed along Vicente Creek, this latter series rests unaltered against the crystalline complex. The latter in this vicinity consists of mica, hornblende, and chloritic schists and quartzite, with many bodies of crystalline limestone. Dikes of granular character, consisting of quartz and feldspar, also those of very coarse hornblende and feldspar, with others of a more basic character abound. The pre-Cretaceous rocks near the contact are crushed and filled with quartz veins. The limestone is very highly crystalline, and in many places is characterized by the presence of molybdenite, pyroxene, and a golden-colored mica. Garnets are very abundant in the schists in this portion of the Santa Lucia. The limestone increases in amount toward the northwest, and on Mill Creek is enormously developed. It extends from the summit of the mountains at an elevation of 4,000 ft. down Mill Creek to within half a mile of the ocean. It is often interstratified in the schists in bodies of no great size, but beds apparently several thousand feet in thickness appear in the higher portion of the range. They apparently extend through a vertical distance of many thousand feet of schists. Mountain movements have subjected the rocks to such strain that the limestone beds are broken into innumerable fragments, so that in getting out rock for the Rockland Lime Company, whose limekilns are located on Mill Creek, no solid unbroken beds could be found. The whole side of the cañon appears to be formed of a loose aggregate of angular limestone fragments. The limestone beds lie in the form of a V, extending down nearly to the ocean on the South Fork of Mill Creek, and retreating again to the summit of the mountains in the direction of the head of the North Fork. The limestone appears in enormous masses on the summit east of Big Cañon. They were examined nearly to Hot Springs Creek, and are reported to extend northward as far as Pico Blanco, a prominent mountain back of the Sur. The limestone is everywhere exceedingly metamorphosed, and though examined carefully in many places not a trace of life was detected.

Considerable metamorphosed rocks of various kinds, together with decomposed eruptives, outcrop along the ocean near the mouth of Mill Creek. It was not determined certainly to which series of rocks they belonged. The crystalline schists retreat toward the higher mountains north of Mill Creek, and there is a corresponding expansion of the pre-Cretaceous series, sandstone, including dikes of serpentine, appearing nearly half way to the summit. It was noticed that without exception the eruptives characteristic of the pre-Cretaceous series do not appear in the crystalline rocks, although it would seem in places that the eruptive must be intrusive in them below the surface. South of Big Cañon the sandstones of the older series were seen resting on the granular chloritic schists without exhibiting any metamorphism, thus demonstrating conclusively the great break between the two formations. Except for two small outcrops of limestone north of Salmon Creek, none was seen in the pre-Cretaceous series in this part of the State, while the limestones of the crystalline complex were seen to extend up to the contact and no farther. South of Big Cañon, and between the pre-Cretaceous series and the coast, is a strip of dioritic rocks through which the creek has cut a deep and narrow gorge. On the north fork of the creek, below Dolan's Hot Springs, occur serpentine shales and sandstones, and above them the granitic rocks.



From Big Cañon the narrow strip of pre-Cretaceous extends up the coast to and past Slate's Hot Springs. In fact, the series is reported to reach as far north as Point Sur. The strip is less than a mile wide, and consists of shales, sandstone, and jasper. The series terminates at the base by a conglomerate resting against the crystalline schists. The dip is either a very steep one away from the range, or, as it is in places, into the range. The conglomerate has a thickness of several hundred feet, but its extent along the coast was not traced out. The bowlders are all smoothly washed, and the most of them consist of a chloritic granite or gneiss similar to that in the mountains above them. The sandstone matrix is so metamorphosed as to very closely resemble a crystalline rock. At Slate's Springs the conglomerate is followed upward by sandstone, slaty shale, and jasper. The whole series is considerably metamorphosed, and all the members filled with ramifying quartz veinlets. The shale in its metamorphism has assumed the appearance of a fine-grained mica schist. Fragments of a fossil shell belonging to the genus *Inoceramus* were found in the cliffs at the hot springs. The specimens were, however, very poorly preserved, on account of the shaly nature of the inclosing rock, and nothing definite could be made out about them. The basal conglomerate settles conclusively the greater age of the crystalline schists, and probably of the granite also. In addition to the coarse, fresh-looking granite and gneiss of the Santa Lucia range, there are large bodies of granitic rocks with a chloritic constituent in the place of the mica, and which are probably much older.

A very interesting thing in connection with the study of the crystalline schists and the pre-Cretaceous series resting on them, is the fact that not the least sign of the contact is noticeable from a study of the topography. In fact, the whole Santa Lucia range is an anomaly in this regard. The range is unbroken by any low passes indicative of the changing formations. The change in topography from Tertiary to Cretaceous, and from Cretaceous to pre-Cretaceous, is only slightly noticeable, while the pre-Cretaceous laps onto the crystalline schists, gradually thinning out toward the north.

The San Antonio Valley is separated from the Salinas by a line of Miocene hills known as the San Antonio Hills. Rocks of the same age also close in the valley on the north, forming the foothills of the Santa Lucia Peak. Six miles above the old mission the San Antonio River cuts through a ridge of crystalline rocks, above which another small valley opens out, having on its northern side extensive Miocene shales. The whole of the Miocene, as far as was noticed in this section, dips to the northeast at an angle of about  $45^{\circ}$ . The last great elevation seems to have been to the southwest.

The Arroyo Seco is a large stream which cuts nearly across the Santa Lucia range. Miocene rocks are the only ones exposed for about 10 miles above the mouth of the cañon. They are folded together and contorted into every conceivable position. At Abbots the last of the Tertiary is seen resting on the crystalline schists. The latter consist of mica and hornblende schists, varying to gneiss, and intersected very generally by veins of granitic matter. From this point to the summit there is very little variation in the character of the rocks. In places they become almost granitoid. Portions, at least, of San Lucia Peak, the highest mountain in the range, are formed of the coarse white porphyritic granite like that at Monterey. Beginning on the Arroyo Seco,

about 3 miles below the Tassajara Springs, sandstone of supposed Tertiary age is exposed in a long shallow deposit extending several miles to the northwest. It dips about  $40^{\circ}$  to the northeast.

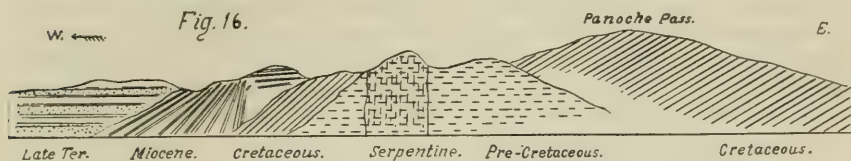
North of the Arroyo Seco the eastern portion of this mountainous region is known as the Soledad Hills. They form a very high and regular mountain wall on the western side of the Salinas Valley for about 25 miles. They are separated from the main portion of the Santa Lucia by the valleys of the upper Carmel River. This range of hills has an elevation of 2,500 ft., and consists of crystalline schists, with occasional bodies of limestone. The Miocene slates extend over the divide from the Arroyo Seco to the Tularcitos, forming the valley of that stream down to its junction with the Carmel, and finally connects with hills of the same age east of Monterey. Mount Toro, at the northern end of the Soledad Hills, shows a considerable body of granite, while the crystalline schists in the region about are filled with granitic dikes. *Fig. 14* gives a section through the Santa Lucia in the region of the Arroyo Seco.

Between Paso Robles and the southern Cholame Valley undisturbed beds of late Tertiary age appear. It is on the east of this valley that the pre-Cretaceous axis of the Mount Diablo range first appears. The pre-Cretaceous series gradually rises from beneath the Tertiary north of Polonio Pass, and forms a ridge of 3,000 ft. elevation north of Parkfield. The Tertiary rises high on both sides, in places capping it, as in the region about the head of Stone's Cañon. The characteristic rocks of the older series are all well represented in this range. They consist of sandstone, shale, and jasper, with eruptives, among which are serpentine and glaucophane schist. The Cholame Valley is bordered on the southwest by Miocene hills. In the edge of the valley, at the base of these hills, is an outcrop of granite, which has been so crushed and decomposed that it can hardly be distinguished from the granitic sandstones adjoining. The granite does not appear prominent, but its position is indicated by a series of soft sandhills extending to the head of the valley. Granite associated with limestone outcrops along Nelson Creek for 2 miles. Both the limestone and granite have been brecciated and the fragments re-cemented. The overlying formation is a soft gypsum-bearing clay, followed down Indian Creek by sandstone and the typical bituminous slate series. Above the Tertiary clays, which are in contact with the granite on the east, rises the main range. On its western slope are large areas of typical banded jasper, showing a fine, wavy structure. The summit is capped by Miocene sandstone and shale, dipping to the northeast at a high angle, and containing the Slack Cañon coal beds. As we descend the northeastern slope from an elevation of 3,500 ft. the pre-Cretaceous series is again encountered and continue down to Carey Creek. Walton Cañon has a length of 6 miles, giving an excellent exposure of sandstone and shale of probable Cretaceous age. The strata dip easterly at an average angle of  $50^{\circ}$ , exposing a thickness of nearly 20,000 ft. *Fig. 15* gives a section of the range at this point.

A great thickness of similar strata appears south of Los Gatos Creek. The pre-Cretaceous series outcrops quite prominently on the southern end of the range of which San Carlos is the dominating peak. It also appears in the mountains along the eastern side of the upper San Benito. West of the river the formation is chiefly Tertiary; farther down

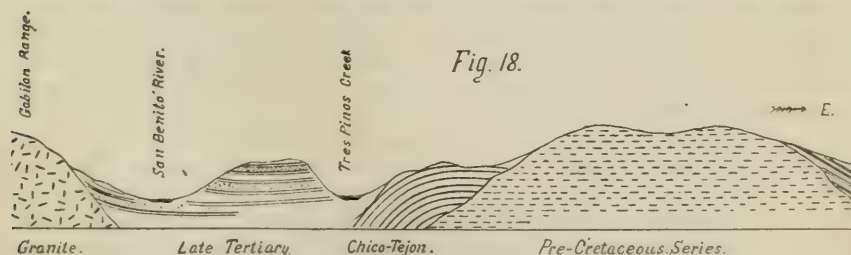
the river cuts through the high range, of which Hepsedam is the culminating peak. The axial rocks of this range belong to the pre-Cretaceous series. Below the point where the river cuts through this range, the flanking hills are all Tertiary. They rise in places in bold cliffs facing the river.

West of New Idria is one of the largest areas of serpentine known in the coast ranges. The features which its surface presents are quite



unusual. Owing to some peculiar manner of decomposition the surface has been so softened that it appears in the form of rounded clay hills, often entirely free from vegetation of any kind. Rising out of these hills are occasionally to be seen mineralized portions carrying quicksilver. All the streams heading in these mountains are strongly impregnated with magnesia. Small areas of the pre-Cretaceous series appear about New Idria. To the east are barren hills in which the stratification of the Chico is very finely shown. The Chico appears well developed along the divide west of Panoche, the road to Tres Pinos crossing it for several miles. Lower down on the Tres Pinos Creek jasper and sandstone of the pre-Cretaceous series outcrops in a low ridge through which the creek runs in a cañon. The sandstones are crumpled and filled with quartz veinlets. Below these rocks is a small outcrop of dark shales, probably Cretaceous. In the hills on the sides of the cañon the Tertiary appears to rest unconformably on the dark shales. A short distance down the cañon the Tertiary has been folded in and stands almost vertically. The dip becomes less as we go down the cañon until it is almost horizontal. Beds of probable Pliocene age follow. The latter consist of but slightly cemented boulder deposits, sandstone, etc., and have been eroded so as to give magnificent exposures.

Fig. 16 gives a diagrammatic sketch of the mountains along the road from Panoche to the San Benito. In the region about the Los Muertos



grant the pre-Cretaceous series forms the summit and the western slope for 15 miles in the direction of Tres Pinos, when it becomes covered by sandstone of probably Chico age. A section across this range to the Gavilan is shown by Fig. 18. Going north from this point up



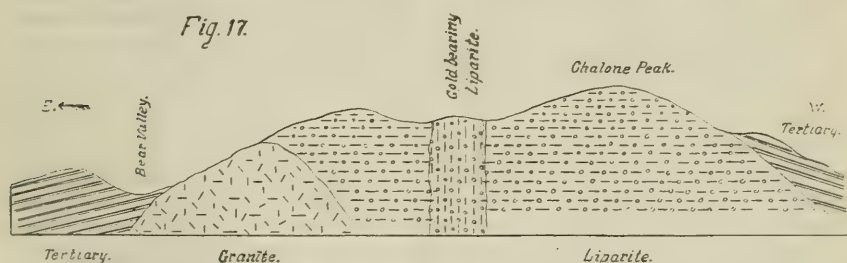
the Arroyo Joaquin Soto the older series disappears and its place is taken by high and rugged mountains on both sides of the valley, formed of liparite lying in nearly horizontal bands, and lesser amounts of more basic lavas. This volcanic country culminates in the San Juan Peaks over 3,000 ft. high. At this point the volcanic rocks have a width of 8 or 10 miles. They have a thickness as exposed in the mountains bordering the Joaquin Soto of fully 1,000 ft. The lava is exposed nearly to the foot of the grade on the road from Staytonville to Hollister. At its lowest exposures it is shown to rest on shales and sandstone probably belonging to the Chico. The antimony and quicksilver deposits about Staytonville occur in fissures in the liparite. It seems probable that the greatest thickness of the flow is as much as 1,500 ft. The variation in the lavas here makes this one of the most interesting regions in the coast ranges for the study of volcanic rocks.

The Gavilan range is essentially a granitic one. It is evident that the granite on the west of Cholame Valley and in the cañon of Nelson Creek belongs to the southeast prolongation of this axis. This seems probable, not only from position, but from physical characters. Granite detritus is abundant in Slack's Cañon, while farther to the northwest there is another link, the granite outcropping prominently in the cañon of Lorenzo Creek, below Lone Oak. The greater portion of the latter exposure is a massive granite with glassy feldspars and small crystals of titanite. Granite appears again on Chalone Creek at the eastern base of the peaks, but the southern portion of the Gavilan range proper begins about 8 miles north of the peaks. Opposite Gonzales the granite has an exposed width of about 6 miles. The granite outcrops nearly to the base of the range on the Salinas side, while on the northeast, between it and the San Benito, are extensive Tertiary beds, consisting largely of granitic detritus, and extending in places nearly to the summit. As the range is followed northward the granite widens and, associated with crystalline limestone, extends down to the San Benito River, near Willow Creek. The limestone so prominent in this range crosses it slightly diagonally, beginning as just mentioned on the eastern slope near Willow Creek; the beds extend to and over the highest portion, Fremont Peak, and down on the western side. The beds are not continuous, but appear as kidney-shaped bodies. They vary from coarse to finely crystalline. The limestone, though fully as much metamorphosed as that in the Santa Lucia range, is very free from impurities.

North of Peach Tree Creek the pre-Cretaceous series is well developed, consisting of red and brown jasper, sandstone, glaucophane schist, and intrusives of varying character. A small area of these rocks was noted in the hills west of San Benito P. O. In fact, this series probably underlies much of this region which is now covered by the Tertiary, judging from the scattered outcrops which appear so irregularly. The granite axis of the Gavilan has been the scene of the eruption of a number of masses of acid lavas. The most southerly one exposed is about 4 miles west of Parkfield, on the borders of Cholame Valley. There the lavas are all fine-grained and stony, with interstratified layers of obsidian. The rock is evidently acid enough to be classed with the liparites.

The Chalone Peaks form the southern termination of the Gavilan range. The south peak lies at the western extremity of a body of both massive and banded liparite which stretches north for about 6 miles,

with a width of  $2\frac{1}{2}$  miles. The peak has an elevation of about 3,000 ft., descending very abruptly to the west and south, and gradually to the north. Although the whole body seems to belong to the acid series, yet there is a great variety of crystallization products. Obsidian is abundant on the peak as well as in a cañon on the eastern side of the flow. This liparite is particularly interesting on account of containing gold, apparently as an original constituent. There are no signs of a crater, for the amount of erosion since the flow took place must have been enormous, yet everything points to the fact that the matter welled up through fissures, not all at once, but under different conditions and at different times. An immense mass of volcanic tufa stretches along the western side of the solid lavas. It forms the north Chalone Peak, which rises fully 100 ft. higher than any present existing lava. The extent to the north is about 8 miles, considerably beyond any of the lava in place. The tufa dips west at an angle varying from  $30^{\circ}$  to  $60^{\circ}$ . The northern portion has been eroded into deep cañons and high jagged pinnacles,



rising hundreds of feet. One fork of Chalone Creek has cut across the tufa, exposing cliffs nearly 600 ft. high, and which, owing to some peculiarity of structure, weather vertically. The total thickness of the tufas cannot be less than 6,000 ft. They are made up wholly, except at the base, where some granitic gravels are mixed with the volcanic, of more or less rounded boulders of the lava, cemented by a sand of the same material. The relation to the Tertiary indicates that the lavas and tufas are older. *Fig. 17* gives a section of the Chalone Peaks.

Another eruption of liparite appears at the northern end of the range, extending from Mr. Flint's ranch over the summit where the old stage road crosses and some distance down on the western slope. This has a uniform coarse texture. Where the road crosses, the liparite appears to be intruded through sandstone, which is probably of Chico age. The sandstone is much metamorphosed near the liparite and steeply inclined.

#### SUMMARY OF THE VIEWS DISCUSSED IN THE FOREGOING NOTES.

There exists in the central and southern coast ranges granitic axes associated with crystalline schists and metamorphic limestone, all of unknown age. Structurally, the crystalline axes, more particularly that represented by the San José, Santa Lucia, and intermediate occurrences, are the northwest prolongation of the San Emedio range. Tentatively, it may be assumed that the crystalline schists and limestones are of Palæozoic age, and the intruded granite of the same age as the greater portion of the San Bernardino and Peninsula ranges. These rocks are

the oldest known in the coast ranges and form the basement complex upon which the other formations have been successively laid down.

Topographically these ancient rocks are not prominent, save in a few cases, but constitute what might be called a depressed mountain system, of which only the more prominent portions project through the later coverings. It is probable that during early Mesozoic times this mountain system was far more elevated than at present, and that before the lowest uncrystalline sedimentary rocks which have been found were deposited, there was a long interval of erosion, following which a subsidence took place, which was so extreme that very little, if any, land existed through the coast ranges. Following this event the formation which has been variously termed the Metamorphic, Metamorphic-Cretaceous, and pre-Cretaceous, was deposited. Through an extent of 500 miles, and perhaps more, from southeast to northwest, the sedimentary rocks of this series appear. They consist of jasper or phthanite, gray sandstone, conglomerate, and shale or slate when not deformed by crushing. The series has been somewhat metamorphosed, particularly toward the north, where appear mica and hornblende schists. The characteristic metamorphism of the series as a whole, and one which distinguishes it lithologically from all the other formations of the Coast Range, is a chemical one, more pronounced where dynamical effects have been strongest.

This consists in a silicification of all but the softest and more impenetrable argillaceous rocks in the form of interlacing quartz veinlets from microscopic size upward. This is evidently the result of an intense crushing together of the sedimentary strata as well as of the underlying crystalline rocks, filling them with innumerable fractures, through which silicious solutions from the deeper-seated acid rocks percolated; the chemical action being induced on so large a scale by the heat generated, which, however, was not sufficient to produce fusion. Very rarely in the coast ranges is this peculiar metamorphism apparent in any of the succeeding formations, save in the immediate vicinity of the hot springs in the quicksilver regions. The silicification is more pronounced in the harder and more brittle strata. The crushing was so intense that over much of the region under discussion no system of regular folds has yet been made out. The more brittle strata have been fractured, the pliable contorted, and the soft crushed. As this regional silicification has been demonstrated on good evidence to be confined to a series of rocks underlying unconformably the Knoxville, the lowest recognized Cretaceous, and as this boundary line between the Lower Cretaceous and the Upper Jurassic is supposed on good evidence to represent the period of intrusion of the great mass of Mesozoic granite of the Sierra Nevada, it seems highly probable that an action of so intense a character in the adjoining range was the accompaniment and partial agent in the elevation and crushing together of the Coast Range axis, resulting in the silicification described. As far as we yet know this important mountain movement in the coast ranges was not accompanied by granite south of the Klamath Mountain region.

This series of rocks so strongly marked, lithologically, is also characterized by great numbers of intrusives, which are not known to penetrate any of the younger formations. These have undergone the same deformation as the series through which they were erupted, and in most cases their original character cannot be determined by the unaided eye.



All that we can say of them is that they are older than the Knoxville, and, perhaps, in part, antedate the period of intense dynamical metamorphism. Although they may not differ in composition from the eruptives in the Cretaceous, yet, in their present physical character, are generally quite easily distinguished.

Mr. J. S. Diller has recently obtained good evidence that the whole body of Cretaceous north of the 40th parallel is one continuous series of sediments without important physical break. Although to the south no such systematic study of the Cretaceous has been attempted, yet it would seem highly probable from the evidence at hand that the same conditions which obtained in the northern coast ranges during the Cretaceous must have existed without any great modification throughout the whole extent of those ranges. The writer believes that as far as the geological history of the Pacific Coast has been unfolded, no important mountain movements have been shown to be local. Consequently, in studying the rocks of Cretaceous age through the central and southern coast region, wherever we find any portion of the Cretaceous resting unconformably on a basement series of different character, and more or less metamorphosed, it may, with reasonable certainty, be postulated that such a break is good evidence of at least a pre-Knoxville series, and if the Knoxville be continued to be considered the base of the Cretaceous, then of a pre-Knoxville series. Not only have excellent examples of this pre-Knoxville unconformity in the region studied by Mr. Diller, which are included by him in the Klamath Mountains, but also only a short distance to the south in Lake and Napa counties the same has been noted by the writer; while fully 400 miles to the southeast, in almost the extreme southern portion of the coast ranges proper, in the cañon of the Santa Maria, the same unconformity has been noted. Many almost as strongly marked occurrences of a similar nature were observed in San Luis Obispo and Monterey counties. In fact, Dr. Becker, in studying the geology of the New Idria District, demonstrated that the Chico rests unconformably on an older formation, which he considered Lower Cretaceous, but which, in the light of Mr. Diller's studies, as well as those of the writer, must be referred to a pre-Cretaceous series. This proof for the existence of a pre-Cretaceous series should not be, and is not, based on the fact of the Chico having been found unconformable above an older series, for, according to the opinion of the writer, a small unconformity exists in the Cretaceous, but upon the strongly contrasted lithological character.

There is one fact which has been seemingly overlooked in a study of the Cretaceous, and that is the presence in it of innumerable bodies of serpentine from Santa Barbara County to the Oregon line. It is found, according to all recorded observations, to penetrate the pre-Cretaceous basement rocks in both coast ranges and Sierra, and wherever the Knoxville is present that too has been intruded, but the writer cannot find any record of its having been found in the Upper Cretaceous. This fact must necessarily indicate a considerable disturbance at some time during the Cretaceous period. Judging from the physical character of the serpentine, as well as its position stratigraphically, it must have been intruded at about the same time over a large part of the State. In San Luis Obispo County the serpentine occurs intrusive in *Aucella*-bearing shales, but in a number of instances it was distinctly seen to underlie the Chico.

The Lower Cretaceous is generally characterized by dark shale and a subordinate amount of sandstone and conglomerate and small bodies of limestone, while in the Chico sandstone and conglomerates predominate.

Succeeding the uplift, crushing, and metamorphism of the pre-Cretaceous, a subsidence took place, which, without any break save for the eruption of the serpentine, continued through to the close of that period. In Central and Southern California the sedimentation has been recognized as continuing through the Eocene, but in Oregon, according to Diller, a break separates the Cretaceous and the Tertiary.

At the close of the Chico submergence in Central and Southern California but little if any land existed in the Coast Range region. Following the Cretaceous and Eocene in this region it is probable that a considerable elevation took place accompanied by a folding of this series. After a period of erosion a subsidence again took place to an extent almost as great as during the Cretaceous. On the eroded Cretaceous, pre-Cretaceous, and granitic rocks a great thickness of Miocene was laid down. This latter formation consists of sandstone and conglomerates, light-colored banded slates, and gypsum-bearing clays. At the close of the Miocene another upheaval took place, which elevated portions of the coast ranges over 5,000 ft. This is particularly noticeable in the southern coast ranges, in Santa Barbara and northern Ventura counties. Post-Pliocene movements have also been very pronounced.

[NOTE.—Since the plates were prepared for this reconnaissance report on the southern coast ranges, the conclusion has been reached that the fossils which were at first supposed to be Tejon are probably Chico. It seems then, according to our present knowledge, that the Tejon is not recognized with certainty in the region described. The reader is asked to consider all references to the Chico-Tejon in the sketches as meaning Chico.]

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# APPENDIX.

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State Mining Bureau Act.

Mine Bell Signal Act.

Act defining Hydraulic Mining.

Debris Commissioner Act.

The Caminetti Act.

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## APPENDIX.

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### STATE MINING BUREAU ACT.

CHAPTER CLXXIII.—*An Act to provide for the establishment, maintenance, and support of a bureau, to be known as the State Mining Bureau; and for the appointment and duties of a Board of Trustees, to be known as the Board of Trustees of the State Mining Bureau, who shall have the direction, management, and control of said State Mining Bureau, and to provide for the appointment, duties, and compensation of a State Mineralogist, who shall perform the duties of his office under the control, direction, and supervision of the Board of Trustees of the State Mining Bureau.*

[Approved March 23, 1893.]

*The People of the State of California, represented in Senate and Assembly, do enact as follows:*

SECTION 1. There shall be, and there is hereby, established in the State of California a Mining Bureau, the principal office of which shall be maintained in the city of San Francisco, which said Mining Bureau shall be under the supervision of a Board of Trustees, to be known as the Board of Trustees of the State Mining Bureau; and it shall be the duty of, and the Governor of the State of California is hereby authorized and empowered to appoint five residents and citizens of the State to be such Trustees.

SEC. 2. The appointees shall take the same oath of office as other State officers, and when duly qualified and assembled shall constitute the Board of Trustees of the State Mining Bureau. They shall hold office for four years from the date of their appointment, or until the qualification of their successors, and shall receive no compensation for their services. They shall have control of all properties and funds of said Bureau, and shall have the power, by the name of said Board, to sue and defend. Three of them shall constitute a quorum for the transaction of business. They shall elect one of their number to be President of said Board, and shall keep a record of their proceedings. They shall adopt rules and regulations for their government not in conflict with the laws of the State.

SEC. 3. It shall be the duty of the Governor of the State of California, and he is hereby empowered, to appoint a citizen and resident of this State, having a practical and scientific knowledge of mining and mineralogy, to the office of State Mineralogist, which office is hereby created. Said State Mineralogist shall hold his office for the term of four years from the date of his appointment, or until the qualification of his successor. He shall take and subscribe the same oath of office as the other State officers, and shall give bond for the faithful performance of his

duties in the sum of twenty-five thousand dollars, said bond to be approved by the Governor of the State of California. He shall receive for his services a salary of two hundred and fifty dollars per month, to be paid in the same manner as the salaries of other State officers, and shall also receive his necessary traveling expenses when traveling on the business of his office, said expenses, when approved by the Board of Trustees of the Mining Bureau, to be allowed and audited by the State Board of Examiners. The said salary and expenses shall be paid out of the Mining Bureau Fund, herein provided for, and not otherwise.

SEC. 4. It shall be the duty of said State Mineralogist to make, facilitate, and encourage special studies of the mineral resources and mineral industries of the State. It shall be his duty to collect statistics concerning the occurrence of the economically important minerals and the methods pursued in making their valuable constituents available for commercial use; to make a collection of typical geological and mineralogical specimens, especially those of economic or commercial importance, such collection constituting the Museum of the State Mining Bureau; to provide a library of books, reports, and drawings bearing upon the mineral industries, the sciences of mineralogy and geology, and the arts of mining and metallurgy, such library constituting the Library of the State Mining Bureau; to make a collection of models, drawings, and descriptions of the mechanical appliances used in mining and metallurgical processes; to preserve and so maintain such collections and library as to make them available for reference and examination and open to public inspection at reasonable hours; to maintain, in effect, a bureau of information concerning the mineral industries of this State, to consist of such collections and library, and to arrange, classify, catalogue, and index the data therein contained, in a manner to make the information available to those desiring it, and to provide a custodian specially qualified to promote this purpose; to make a biennial report to the Board of Trustees of the Mining Bureau, setting forth the important results of his work, and to issue from time to time such bulletins as he may deem advisable concerning the statistics and technology of the mineral industries of this State.

SEC. 5. Said State Mineralogist shall have the right to appoint competent assistants and qualified specialists when necessary in the execution of his plans, and fix their compensations; but all such appointments and compensations shall be subject to the approval and confirmation of said Board of Trustees, and shall not become effective unless so confirmed and approved. And it shall be the duty of the State Mineralogist to consult the said Board of Trustees upon all matters appertaining to his official duties, and he shall at all times perform such duties subject to the supervision and approval of said Board of Trustees.

SEC. 6. It shall be the duty of the Board of Trustees of the State Mining Bureau, when the funds of said Mining Bureau will permit, to procure and maintain the necessary rooms and furniture for the offices and uses of the said Board of Trustees and the State Mineralogist, and the museum and library of the Mining Bureau, in San Francisco; *provided, however*, that the entire expenses of the State Mining Bureau for salaries, assistance, light, rent, fuel, furniture, and all other things pertaining to said Bureau, must not, in any one year, be greater than can be paid out of the Mining Bureau Fund herein provided.



SEC. 7. The Board of Trustees of the State Mining Bureau shall manage and control all the finances of said Mining Bureau, and shall make rules regulating the custody and disbursement of the funds of the State Mining Bureau, and the mode of drawing the same from the State Treasury.

SEC. 8. The Board of Trustees of the State Mining Bureau shall biennially report to the Governor of the State the condition of the Bureau, with a statement of the receipts and disbursements in detail, and with said report shall be incorporated the biennial report of the State Mineralogist, and the report of said Board of Trustees and State Mineralogist shall be printed as are the reports of the other State officers.

SEC. 9. The Board of Trustees of the State Mining Bureau are hereby empowered and authorized to receive, on behalf of the State, for the use and benefit of the State Mining Bureau, gifts, bequests, devises, and legacies of real or other property, and to use the same in accordance with the wishes of the donors; and if no instructions are given by said donors, to manage, use, and dispose of the said gifts, bequests, and legacies for the best interests of the said Mining Bureau in the manner they may deem proper.

SEC. 10. The State Mineralogist may, with the approval of the Board of Trustees of the State Mining Bureau, prepare a special collection of ores and minerals of California, to be sent to any World's Fair or Exposition at which they may deem it advisable or desirable to display the mineral wealth of the State.

SEC. 11. The Mining Bureau Fund herein mentioned, and out of which all the expenses of the State Mining Bureau shall be paid, shall consist of such property or moneys as may come into the hands of the Board of Trustees of said Bureau by gift, bequest, devise, or legacy; of such moneys as may, from time to time, be appropriated by the Legislature of the State for the use of said Bureau, and of such moneys as shall be paid into the State Treasury for the use and benefit of said Bureau, as provided in the following section.

SEC. 12. It shall be the duty of the Tax Collectors in the several counties in the State, and of the License Collector of the City and County of San Francisco, on the second Monday in January, April, July, and October, in each year, to transmit by express, to the State Treasury, all moneys collected by them from mining corporations, or from corporations formed for milling ores or for supplying water for mining purposes, under or by virtue of the Act entitled "An Act imposing a tax on the issue of certificates of stock corporations," approved April first, eighteen hundred and seventy-eight, and to forward to the State Controller, by mail, a certificate showing the amount of money so forwarded to the State Treasurer, and the date when the same was transmitted, and also showing the names of the several corporations from which the same was received, and the amount received from each. The State Treasurer shall receive the amounts so transmitted, and give duplicate receipts therefor, one of which shall be filed with the State Controller, and the other shall be forwarded to the Collector from whom the money was received; and after paying, out of the money so received, the charges for the transmission thereof, the amount of which shall be noted on the receipt filed with the State Controller, he shall retain the remainder in his hands and place it in the Mining Bureau Fund, said

Mining Bureau Fund to be used only in the payment of drafts made for the expenses of the Mining Bureau established under this Act.

SEC. 13. Such Tax Collectors and License Collectors shall hereafter be required to pay into the County Treasuries of their respective counties only that portion of the moneys collected by them under the Act of Legislature mentioned in the last preceding section, approved April first, eighteen hundred and seventy-eight, which is collected from corporations other than those mentioned in section twelve of this Act.

SEC. 14. The Board of Trustees now known as the Board of Trustees of the State Mining Bureau shall perform the duties of the Board of Trustees of the State Mining Bureau, as in this Act provided, and administer the affairs of the State Mining Bureau, as in this Act provided, until the appointment and qualification of their successors, as in this Act provided; and the State Mineralogist now performing the duties of the office of State Mineralogist shall perform the duties of the office of State Mineralogist, as in this Act provided, until the appointment and qualification of his successor, as in this Act provided.

SEC. 15. The Act entitled "An Act to provide for the establishment and maintenance of a Mining Bureau," approved April sixteenth, eighteen hundred and eighty, and the Act entitled "An Act supplementary to an Act entitled 'An Act for the establishment and maintenance of a Mining Bureau,' approved April sixteenth, eighteen hundred and eighty," approved March twenty-first, eighteen hundred and eighty-five, and all Acts and parts of Acts in conflict with the provisions of this Act, are hereby repealed.

SEC. 16. This Act shall take effect and be in force from and after its passage.

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## ACT ESTABLISHING A SYSTEM OF MINE BELL SIGNALS.

CHAPTER LXXIV.—*An Act to establish a uniform system of mine bell signals, to be used in all the mines operated in the State of California, and for the protection of miners.*

[Approved March 8, 1893.]

*The People of the State of California, represented in Senate and Assembly, do enact as follows:*

SECTION 1. Every person, company, corporation, or individual, operating any mine within the State of California—gold, silver, copper, lead, coal, or any other metal or substance—where it is necessary to use signals by means of bell or otherwise, for shafts, inclines, drifts, crosscuts, tunnels, and underground workings, shall, after the passage of this bill, adopt, use, and put in force the following system or code of mine bell signals, as follows:

- 1 bell, to hoist. (See Rule 2.)
- 1 bell, to stop if in motion.
- 2 bells, to lower. (See Rule 2.)
- 3 bells, man to be hoisted; run slow. (See Rule 2.)
- 4 bells, start pump if not running, or stop pump if running.
- 1—3 bells, start or stop air compressor.

5 bells, send down tools. (See Rule 4.)

6 bells, send down timbers. (See Rule 4.)

7 bells, accident; move bucket or cage by verbal orders only.

1—4 bells, foreman wanted.

2—1—1 bells, done hoisting until called.

2—1—2 bells, done hoisting for the day.

2—2—2 bells, change buckets from ore to water, or vice versa.

3—2—1 bells, ready to shoot in the shaft. (See Rule 3.)

Engineer's signal, that he is ready to hoist, is to raise the bucket or cage two feet and lower it again. (See Rule 3.)

Levels shall be designated and inserted in notice hereinafter mentioned. (See Rule 5.)

SEC. 2. For the purpose of enforcing and properly understanding the above code of signals, the following rules are hereby established:

Rule 1. In giving signals make strokes on bell at regular intervals. The bar (—) must take the same time as for one stroke of the bell, and no more. If timber, tools, the foreman, bucket, or cage are wanted to stop at any level in the mine, signal by number of strokes on the bell, number of the level first before giving the signal for timber, tools, etc. Time between signals to be double bars (— —). Examples:

6— —5 would mean stop at sixth level with tools.

4— —1—1—1— —1, would mean stop at fourth level, man on, hoist.

2— —1—4 would mean stop at second level with foreman.

Rule 2. No person must get off or on the bucket or cage while the same is in motion. When men are to be hoisted give the signal for men. Men *must* then get on bucket or cage, *then* give the signal to hoist. Bell cord must be in reach of man on the bucket or cage at stations.

Rule 3. After signal "Ready to shoot in shaft," engineer must give his signal when he is ready to hoist. Miners must then give the signal of "Men to be hoisted," then "spit fuse," get into the bucket, and give the signal to hoist.

Rule 4. All timbers, tools, etc., "longer than the depth of the bucket," to be hoisted or lowered, must be securely lashed at the upper end to the cable. Miners must know they will ride up or down the shaft without catching on rocks or timbers and be thrown out.

Rule 5. The foreman will see that one printed sheet of these signals and rules for each level and one for the engine-room are attached to a board not less than twelve inches wide by thirty-six inches long, and securely fasten the board up where signals can be easily read at the places above stated.

Rule 6. The above signals and rules must be obeyed. Any violation will be sufficient grounds for discharging the party or parties so doing. No person, company, corporation, or individuals operating any mine within the State of California, shall be responsible for accidents that may happen to men disobeying the above rules and signals. Said notice and rules shall be signed by the person or superintendent having charge of the mine, who shall designate the name of the corporation or the owner of the mine.

SEC. 3. Any person or company failing to carry out any of the provisions of this Act shall be responsible for all damages arising to or incurred by any person working in said mine during the time of such failure.

SEC. 4. This Act shall take effect immediately.



## ACT DEFINING HYDRAULIC MINING.

CHAPTER CCXXIII.—*An Act to amend an Act entitled an Act to establish a Civil Code, approved March 21, 1872, by adding thereto two sections, to be known as sections one thousand four hundred and twenty-four and one thousand four hundred and twenty-five, being title nine, part four, division two, of said Code, concerning the manner of conducting the business of hydraulic mining.*

[Approved March 24, 1893.]

*The People of the State of California, represented in Senate and Assembly, do enact as follows:*

1. The Civil Code of the State of California is hereby amended by adding thereto a new title, to be known as title nine, of part four, of division two, of said Code, to read as follows:

## TITLE IX—HYDRAULIC MINING.

1424. The business of hydraulic mining may be carried on within the State of California wherever and whenever the same can be carried on without material injury to the navigable streams, or the lands adjacent thereto.

1425. Hydraulic mining, within the meaning of this title, is mining by means of the application of water, under pressure, through a nozzle, against a natural bank.

## DEBRIS COMMISSIONER ACT.

CHAPTER CCXXVIII.—*An Act to provide for the appointment, duties, and compensation of a Debris Commissioner, and to make an appropriation to be expended under his directions in the discharge of his duties as such Commissioner.*

[Approved March 24, 1893.]

*The People of the State of California, represented in Senate and Assembly, do enact as follows:*

SECTION 1. The Governor of the State of California shall, on or before the first day of January, eighteen hundred and ninety-four, appoint a competent civil engineer for a period of four years only, to be known as and called the Debris Commissioner.

SEC. 2. Said Commissioner shall, during the time he shall be actually employed in the discharge of his official duties, receive a compensation of three hundred dollars per month and his necessary traveling expenses, to be allowed by the State Board of Examiners.

SEC. 3. Whenever any Board of Engineers of the United States Government shall have been appointed, with power to adopt plans and specifications for the construction of works for the impounding of mining debris, it shall be the duty of said Debris Commissioner to consult and advise with such Board of Engineers of the United States Govern-

ment, and to examine and pass upon the merits of such works, and said Debris Commissioner shall determine whether or not such works are calculated to and sufficient to protect the navigable waters of the State, and to keep a record of such determinations.

SEC. 4. There is hereby appropriated out of the General Fund of the Treasury of this State not otherwise appropriated, the sum of two hundred and fifty thousand dollars, no warrant against said sum to be drawn or paid until the United States Government shall have appropriated at least an equal amount, to be used in the construction of works for the restraining or impounding of mining debris in California. Said moneys to be paid only upon orders drawn by the Controller, upon the written request of the said Debris Commissioner, and to be drawn only for the payment of not more than one half of the cost of the construction of any such works for restraining and impounding mining debris as shall have been approved by him and duly adopted and recommended by engineers of the United States Government appointed for that purpose.

SEC. 5. The term of office of said Debris Commissioner shall be four years from the date of his appointment. He shall take the same oath of office as is provided by law for other State officers, and before entering upon the discharge of his duties shall give bond, with sufficient sureties, to be approved by the Governor of the State, in the sum of fifty thousand dollars, for the faithful discharge of his duties as such officer.

SEC. 6. The said Debris Commissioner shall have the power to appoint a Secretary, at a monthly salary to be fixed by said Commissioner, not exceeding one hundred and twenty-five dollars per month; said Secretary to hold office at the pleasure of the said Commissioner; *provided, however*, that no Secretary shall be appointed until said Debris Commissioner shall enter upon the actual discharge of his duties.

SEC. 7. All expenditures authorized by the provisions of this Act shall be subject to the approval of the State Board of Examiners; and the State Controller is hereby authorized to draw his warrant for all expenditures not in excess of the appropriation herein provided for, so approved by the State Board of Examiners, and the State Treasurer is hereby directed to pay the same.

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### THE CAMINETTI LAW.

*An Act to create the California Debris Commission and regulate hydraulic mining in the State of California.*

[Approved March 1, 1893.]

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That a commission is hereby created, to be known as the California Debris Commission, consisting of three members. The President of the United States shall, by and with the advice and consent of the Senate, appoint the commission from officers of the Corps of Engineers, United States Army. Vacancies occurring therein shall be filled in like manner. It shall have the authority, and exercise the powers hereinafter set forth, under the supervision of the Chief of Engineers and direction of the Secretary of War.*

SEC. 2. That said commission shall organize within thirty days after its appointment by the selection of such officers as may be required in the performance of its duties, the same to be selected from the members thereof. The members of said commission shall receive no greater compensation than is now allowed by law to each, respectively, as an officer of said Corps of Engineers. It shall also adopt rules and regulations, not inconsistent with law, to govern its deliberations and prescribe the method of procedure under the provisions of this Act.

SEC. 3. That the jurisdiction of said commission, in so far as the same affects mining carried on by the hydraulic process, shall extend to all such mining in the territory drained by the Sacramento and San Joaquin river systems in the State of California. Hydraulic mining, as defined in section eight hereof, directly or indirectly injuring the navigability of said river systems, carried on in said territory other than as permitted under the provisions of this Act, is hereby prohibited and declared unlawful.

SEC. 4. That it shall be the duty of said commission to mature and adopt such plan or plans, from examinations and surveys already made and from such additional examinations and surveys as it may deem necessary, as will improve the navigability of all the rivers comprising said systems, deepen their channels and protect their banks. Such plan or plans shall be matured with a view of making the same effective as against the encroachment of and damage from debris resulting from mining operations, natural erosion, or other causes, with a view of restoring, as near as practicable and the necessities of commerce and navigation demand, the navigability of said rivers to the condition existing in eighteen hundred and sixty, and permitting mining by the hydraulic process, as the term is understood in said State, to be carried on, provided the same can be accomplished without injury to the navigability of said rivers or the lands adjacent thereto.

SEC. 5. That it shall further examine, survey, and determine the utility and practicability, for the purposes hereinafter indicated, of storage sites in the tributaries of said rivers and in the respective branches of said tributaries, or in the plains, basins, sloughs, and tule and swamp lands adjacent to or along the course of said rivers, for the storage of debris or water or as settling reservoirs, with the object of using the same by either or all of these methods to aid in the improvement and protection of said navigable rivers by preventing deposits therein of debris resulting from mining operations, natural erosion or other causes, or for affording relief thereto in flood-time and providing sufficient water to maintain scouring force therein in the summer season; and in connection therewith to investigate such hydraulic and other mines as are now or may have been worked by methods intended to restrain the debris and material moved in operating such mines by impounding dams, settling reservoirs, or otherwise, and in general to make such study of and researches in the hydraulic mining industry as science, experience, and engineering skill may suggest as practicable and useful in devising a method or methods whereby such mining may be carried on as aforesaid.

SEC. 6. That the said commission shall from time to time note the conditions of the navigable channels of said river systems by cross-section surveys or otherwise, in order to ascertain the effect therein of such hydraulic mining operations as may be permitted by its orders and such as is caused by erosion, natural or otherwise.



SEC. 7. That said commission shall submit to the Chief of Engineers, for the information of the Secretary of War, on or before the fifteenth day of November of each year, a report of its labors and transactions, with plans for the construction, completion, and preservation of the public works outlined in this Act, together with estimates of the cost thereof, stating what amounts can be profitably expended thereon each year. The Secretary of War shall thereupon submit same to Congress on or before the meeting thereof.

SEC. 8. That for the purposes of this Act "hydraulic mining" and "mining by the hydraulic process" are hereby declared to have the meaning and application given to said terms in said State.

SEC. 9. That the individual proprietor or proprietors, or in case of a corporation its manager or agent appointed for that purpose, owning mining ground in the territory in the State of California mentioned in section three hereof, which it is desired to work by the hydraulic process, must file with said commission a verified petition, setting forth such facts as will comply with law and rules prescribed by said commission.

SEC. 10. That said petition shall be accompanied by an instrument duly executed and acknowledged, as required by the law of the said State, whereby the owner or owners of such mine or mines surrender to the United States the right and privilege to regulate by law, as provided in this Act, or any law that may hereafter be enacted, or by such rules and regulations as may be prescribed by virtue thereof, the manner and method in which the debris resulting from the working of said mine or mines shall be restrained, and what amount shall be produced therefrom; it being understood that the surrender aforesaid shall not be construed as in any way affecting the right of such owner or owners to operate said mine or mines by any other process or method now in use in said State; *provided*, that they shall not interfere with the navigability of the aforesaid rivers.

SEC. 11. That the owners of several mining claims situated so as to require a common dumping ground or dam or other restraining works for the debris issuing therefrom in one or more sites, may file a joint petition setting forth such facts, in addition to the requirements of section nine hereof; and where the owner of a hydraulic mine or owners of several such mines have and use common dumping sites for impounding debris or as settling reservoirs, which sites are located below the mine of an applicant not entitled to use same, such fact shall also be stated in said petition. Thereupon the same proceedings shall be had as provided for herein.

SEC. 12. A notice specifying briefly the contents of said petition, and fixing a time previous to which all proofs are to be submitted, shall be published by said commission in some newspaper or newspapers of general circulation in the communities interested in the matter set forth therein. If published in a daily paper, such publication shall continue for at least ten days; if in a weekly paper, in at least three issues of the same. Pending publication thereof said commission, or a committee thereof, shall examine the mine and premises described in such petition. On or before the time so fixed all parties interested, either as petitioners or contestants, whether miners or agriculturists, may file affidavits, plans, and maps in support of their respective claims. Further hearings, upon notice to all parties of record, may be granted by the commission when necessary.

SEC. 13. That in case a majority of the members of said commission, within thirty days after the time so fixed, concur in a decision in favor of the petitioner or petitioners, the said commission shall thereupon make an order directing the methods and specifying in detail the manner in which operations shall proceed in such mine or mines; what restraining or impounding works, if facilities therefor can be found, shall be built, and maintained; how and of what material; where to be located; and in general set forth such further requirements and safeguards as will protect the public interests and prevent injury to the said navigable rivers, and the lands adjacent thereto; with such further conditions and limitations as will observe all the provisions of this Act in relation to the working thereof and the payment of taxes on the gross proceeds of the same; *provided*, that all expense incurred in complying with said order shall be borne by the owner or owners of such mine or mines.

SEC. 14. That such petitioner or petitioners must within a reasonable time present plans and specifications of all works required to be built in pursuance of said order, for examination, correction, and approval by said commission; and thereupon work may immediately commence thereon under the supervision of said commission or representative thereof attached thereto from said Corps of Engineers, who shall inspect same from time to time. Upon completion thereof, if found in every respect to meet the requirements of the said order and said approved plans and specifications, permission shall thereupon be granted to the owner or owners of such mine or mines to commence mining operations, subject to the conditions of said order and the provisions of this Act.

SEC. 15. That no permission granted to a mine owner or owners under this Act shall take effect, so far as regards the working of a mine, until all impounding dams or other restraining works, if any are prescribed by the order granting such permission, have been completed and until the impounding dams or other restraining works or settling reservoirs provided by said commission have reached such a stage as, in the opinion of said commission, it is safe to use the same; *provided, however*, that if said commission shall be of the opinion that the restraining and other works already constructed at the mine or mines shall be sufficient to protect the navigable rivers of said systems and the work of said commission, then the owner or owners of such mine or mines may be permitted to commence operations.

SEC. 16. That in case the joint petition referred to in section eleven hereof is granted, the commission shall fix the respective amounts to be paid by each owner of such mines toward providing and building necessary impounding dams or other restraining works. In the event of a petition being filed after the entry of such order, or in case the impounding dam or dams or other restraining works have already been constructed and accepted by said commission, the commission shall fix such amount as may be reasonable for the privilege of dumping therein, which amount shall be divided between the original owners of such impounding dams or other restraining works in proportion to the amount respectively paid by each party owning the same. The expense of maintaining and protecting such joint dam or works shall be divided among mine owners using the same in such proportion as the commission shall determine. In all cases where it is practicable, restraining and impound-

ing works are to be provided, constructed, and maintained by mine owners near or below the mine or mines before reaching the main tributaries of said navigable waters.

SEC. 17. That at no time shall any more debris be permitted to be washed away from any hydraulic mine or mines situated on the tributaries of said rivers and the respective branches of each, worked under the provisions of this Act, than can be impounded within the restraining works erected.

SEC. 18. That the said commission may at any time, when the condition of the navigable rivers or when the capacities of all impounding and settling facilities erected by mine owners, or such as may be provided by Government authority, requires same, modify the order granting the privilege to mine by the hydraulic mining process so as to reduce amount thereof to meet the capacities of the facilities then in use, or if actually required in order to protect the navigable rivers from damage, may revoke same until the further notice of the commission.

SEC. 19. That an intentional violation on the part of a mine owner or owners, company, or corporation, or the agents or employes of either, of the conditions of the order granted pursuant to section thirteen, or such modifications thereof as may have been made by said commission, shall work a forfeiture of the privileges thereby conferred, and upon notice being served by the order of said commission upon said owner or owners, company, or corporation, or agent in charge, work shall immediately cease. Said commission shall take necessary steps to enforce its orders in case of the failure, neglect, or refusal of such owner or owners, company, or corporation, or agents thereof, to comply therewith, or in the event of any person or persons, company, or corporation working by said process in said territory contrary to law.

SEC. 20. That said commission, or a committee therefrom, or officer of said corps assigned to duty under its orders, shall, whenever deemed necessary, visit said territory and all mines operating under the provisions of this Act. A report of such examination shall be placed on file.

SEC. 21. That the said commission is hereby granted the right to use any of the public lands of the United States, or any rock, stone, timber, trees, brush, or material thereon or therein, for any of the purposes of this Act; that the Secretary of the Interior is hereby authorized and requested, after notice has been filed with the Commissioner of the General Land Office by said commission, setting forth what public lands are required by it under the authority of this section, that such land or lands shall be withdrawn from sale and entry under the laws of the United States.

SEC. 22. That any person or persons who willfully or maliciously injure, damage, or destroy, or attempt to injure, damage, or destroy, any dam or other work erected under the provisions of this Act for restraining, impounding, or settling purposes, or for use in connection therewith, shall be guilty of a misdemeanor, and upon conviction thereof shall be fined not to exceed the sum of five thousand dollars or be imprisoned not to exceed five years, or by both such fine and imprisonment, in the discretion of the court. And any person or persons, company, or corporation, their agents or employes, who shall mine by the hydraulic process, directly or indirectly injuring the navigable waters of the United States, in violation of the provisions of this Act, shall be



guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not exceeding five thousand dollars, or by imprisonment not exceeding one year, or by both such fine and imprisonment, in the discretion of the court; *provided*, that this section shall take effect on the first day of May, eighteen hundred and ninety-three.

SEC. 23. That upon the construction by the said commission of dams or other works for the detention of debris from hydraulic mines and the issuing of the order provided for by this Act to any individual, company, or corporation to work any mine or mines by hydraulic process, the individual, company, or corporation operating thereunder working any mine or mines by hydraulic process, the debris from which flows into or is in whole or in part restrained by such dams or other works erected by said commission, shall pay a tax of three per centum on the gross proceeds of his, their, or its mine so worked, which tax of three per centum shall be ascertained and paid in accordance with regulations to be adopted by the Secretary of the Treasury, and the Treasurer of the United States is hereby authorized to receive the same. All sums of money paid into the Treasury under this section shall be set apart and credited to a fund to be known as the "Debris Fund," and shall be expended by said commission under the supervision of the Chief of Engineers and direction of the Secretary of War, in addition to the appropriations made by law, in the construction and maintenance of such restraining works and settling reservoirs as may be proper and necessary; *provided*, that said commission is hereby authorized to receive and pay into the Treasury from the owner or owners of mines worked by the hydraulic process, to whom permission may have been granted so to work under the provisions hereof, such money advances as may be offered to aid in the construction of such impounding dams or other restraining works, or settling reservoirs, or sites therefor, as may be deemed necessary by said commission to protect the navigable channels of said river systems, on condition that all moneys so advanced shall be refunded as the said tax is paid into the said Debris Fund; *and provided further*, that in no event shall the Government of the United States be held liable to refund same except as directed by this section.

SEC. 24. That for the purpose of securing harmony of action and economy in expenditures in the work to be done by the United States and the State of California, respectively, the former in its plans for the improvement and protection of the navigable streams, and to prevent the depositing of mining debris or other materials within the same, and the latter in its plans authorized by law for the reclamation, drainage, and protection of its lands, or relating to the working of hydraulic mines, the said commission is empowered to consult thereon with a commission of engineers of said State, if authorized by said State for said purpose, the result of such conference to be reported to the Chief of Engineers of the United States Army, and, if by him approved, shall be followed by said commission.

SEC. 25. That said commission, in order that such material as is now or may hereafter be lodged in the tributaries of the Sacramento and San Joaquin river systems resulting from mining operations, natural erosion, or other causes, shall be prevented from injuring the said navigable rivers, or such of the tributaries of either as may be navigable, and the land adjacent thereto, is hereby directed and empowered, when appropriations are made therefor by law, or sufficient money is deposited for that

purpose in said Debris Fund, to build at such points above the head of navigation in said rivers and on the main tributaries thereof, or branches of such tributaries, or at any place adjacent to the same, which, in the judgment of said commission, will effect said object (the same to be of such material as will insure safety and permanency), such restraining or impounding dams, and settling reservoirs, with such canals, locks, or other works adapted and required to complete the same. The recommendations contained in Executive Document numbered two hundred and sixty-seven, Fifty-first Congress, second session, and Executive Document numbered ninety-eight, Forty-seventh Congress, first session, as far as they refer to impounding dams, or other restraining works, are hereby adopted, and the same are directed to be made the basis of operations. The sum of fifteen thousand dollars is hereby appropriated from moneys in the Treasury not otherwise appropriated, to be immediately available to defray the expenses of said commission.



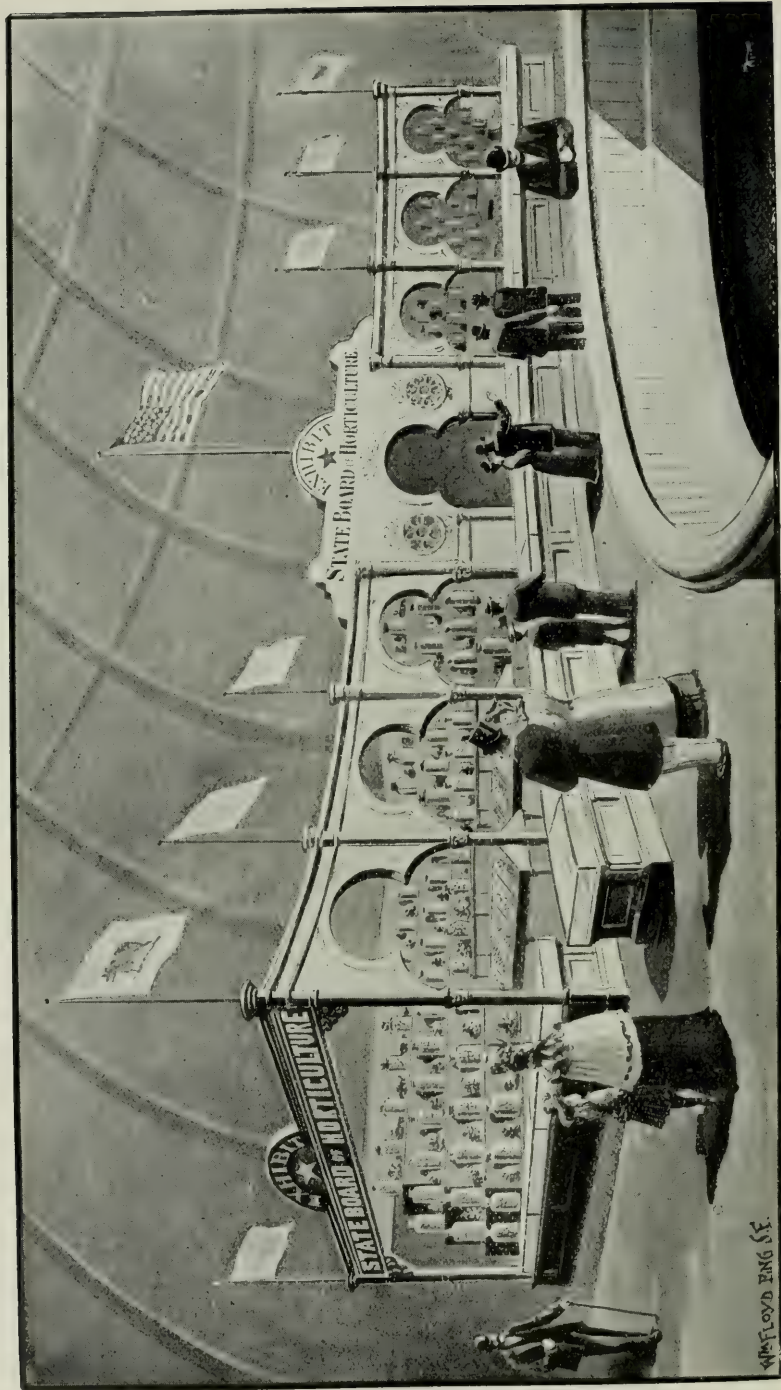












FRONTISPIECE.—Main section of exhibit of State Board of Horticulture, in Horticultural Building, California Midwinter International Exposition, 1894.

W. F. COYD ENG. SE.

FOURTH BIENNIAL REPORT

OF THE

STATE BOARD OF HORTICULTURE

OF THE

STATE OF CALIFORNIA,

FOR 1893-94.



SACRAMENTO:

STATE OFFICE, : : : : A. J. JOHNSTON, SUPT. STATE PRINTING.

1894.

# CALIFORNIA STATE BOARD OF HORTICULTURE.

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ALEXANDER CRAW.....	Quarantine Officer and Entomologist.
ELLA F. HALLAHAN.....	Clerk.

OFFICES:  
No. 220 SUTTER STREET, SAN FRANCISCO, CAL.



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# I.

## REPORT.

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*To his Excellency H. H. MARKHAM, Governor:*

In accordance with law, we have the honor to submit herewith our report for the years 1893-4.

### REPORT FOR 1893.

In 1889 the law governing the time of issuing reports of this Board was changed from biennially to annually. Since then we have published four annual reports—1889, 1890, 1891, 1892. In 1891 a general law was passed changing the time of making reports from annually to biennially. The report for 1892 being the fourth and last one issued annually, the present report becomes the fourth biennial report, and the tenth issued since the creation of this department.

### MEETINGS OF FRUIT GROWERS.

During the year we have, at various times, called the fruit growers of the State in general convention, for the consideration of subjects of great importance to their industry, and in which we have had their coöperation. In November, 1892, the Sixteenth State Convention was held, under the auspices of the Board, at San José, and was largely attended by representative fruit men. In November, 1893, the Seventeenth Convention was held in Los Angeles, continuing in session four days. The proceedings of these two conventions are embodied in the present report, the contents of which will prove, as have all others published by the Board, of incalculable value to the fruit growers of the State, being deductions from practical and experienced men, who have devoted years to the development of this great industry—Horticulture.

In July last, a convention of persons interested in the culture of the olive and the manufacture of olive oil was held at the offices of the Board in San Francisco, which was largely attended and many valuable papers were presented. The proceedings were published in pamphlet form and given wide circulation. Placing such information before the public has had the effect of creating in the minds of the people a knowledge of the great importance of a more general use of pure olive oil as food and for medicinal purposes. It has also called the attention of the people to the wholesale adulteration of food products, where the price can be cheapened by the admixture of worthless and dangerous substances, and suggested methods to arrest the evil.

At these meetings the methods of disposing of our fruit products have formed a part of our programme, and we have strongly advocated that



the growers generally combine and establish a State Fruit Exchange, on a similar basis as the California Fruit Union, which was organized for the marketing of green fruits, at one of our conventions, held in 1885, through which their prepared and dried products be sold and future markets sought. The resolutions passed at these meetings were properly certified to, engrossed, and transmitted to whom addressed. Replies regarding their ultimate action are on file at this office.

In July last, a mass convention of fruit growers was held, under our auspices, in San Francisco, for the purpose of taking immediate action regarding the proposed new tariff on fruit and fruit products, and to furnish to the Congressional Committee detailed statements concerning the different horticultural industries and products and the need of a tariff on said products in accordance with the following resolution:

*"Resolved, That the State Convention of Fruit Growers, and those interested in fruit culture, be called to meet in San Francisco about July 15th next, to formulate such information as is desired by the California Representatives in Congress, on the necessity for duties on fruits and fruit products."*

The attendance was large and most of the fruit-growing counties were represented. Straight detailed arguments were prepared by the convention and forwarded to each member of Congress from California. Since that time we have continued corresponding with our representatives in Washington, and have furnished them from time to time with all the information they have required in arguing this question before the committee having the framing of the bill in charge.

#### FORESTRY.

Forestry protection is rapidly gaining ground. The Government seems to be alive to the importance of forest preservation, and is determined to stop the wholesale devastation which has been going on in almost every part of the country. This is gratifying. Our fruit growers have taken an active part in this discussion at all the conventions for many years.

#### PURE FOOD LEGISLATION.

The Pure Food Bill, pending in the House of Representatives at the last session, did not reach its passage. We forwarded resolutions asking the passage of this bill. It is most unfortunate that no measure nor means can be inaugurated to put a stop forever to the adulteration of every food product.

#### VAGRANT ACT.

We regret that at the last Legislature no effort was made to amend the Vagrant Act. Farmers and fruit growers in rural districts at times are burdened by a tramping population, who roam the country and keep people in constant fear. Much injury is done, and occasionally serious crimes are committed.

#### IMITATION OLIVE OIL.

The last Legislature passed a bill, prepared by the Board, to regulate the sale of imitation olive oil. The bill provides that every article, substance, or compound, or oil other than that extracted solely from the

fruit of the olive tree, is declared to be "imitation olive oil," and any person who adulterates or manufactures imitation olive oil must place (under heavy penalty) a label on the can, bottle, or vessel, bearing the words "imitation olive oil," printed thereon in capital letters, in a clear and durable manner, in the English language, in plain type designated and known as twenty-four-point letter type (two-line pica) of a Gothic face; said label shall also state plainly the name and address of the manufacturer or compounder, the name and place where manufactured or put up, and also the names and actual percentages of the different ingredients contained in each bottle, can, or vessel. It also prohibits imitation olive oil to be transported unless marked as such, and also prohibits oil bearing the semblance of olive oil, manufactured out of the State, to be sold under the representation that it is manufactured in this State; and makes it a misdemeanor to offer for sale any such oil upon the receptacle of which is any cut, design, or mark intended to convey the belief that such is manufactured in this State. (Statutes of California, 1893, pp. 210-211.)

#### TAXING TREES AND VINES.

The Legislature, at its last session, also passed the following constitutional amendment (No. 7), which is to be voted on at the coming general election in November, 1894, to which the attention of fruit growers in general is called:

"A resolution proposing an amendment to the Constitution of the State of California, by adding a new section to article thirteen of said Constitution, to be numbered section twelve and three fourths (12¾), relating to revenue and taxation. (Adopted March 3, 1893.)

"*Resolved by the Assembly, and the Senate concurring,* That the Legislature of the State of California, at its thirteenth session, commencing on the second day of January, eighteen hundred and ninety-three, two thirds of all the members elected to each house of said Legislature voting in favor thereof, hereby propose that article thirteen of said Constitution be amended by adding to said article a new section, to be numbered section twelve and three fourths, to read as follows:

"SEC. 12¾. Fruit and nut bearing trees under the age of four years from the time of planting in orchard form, and grapevines under the age of three years from the time of planting in vineyard form, shall be exempt from taxation, and nothing in this article shall be construed as subjecting such trees and grapevines to taxation."

We especially call attention to this matter, because it is of great importance, and which is becoming an obstacle in fruit growing in California. Heretofore trees have been taxed as improvements. Bare land is taxed at its real value, and its value is not enhanced materially as long as it remains unplanted. As soon as it is set out to fruits, its value necessarily increases, and thus aids in the enhancement of the State's wealth. Under the existing conditions the trees planted on said land become taxable property. They are taxed in addition to the value of the land. They are taxed before they give any return to the owner. In other words, it is taxing unproductive orchards.

This State could better afford to pay a bonus to people setting out young orchards than to force the collection of this unjust tax. To impress the point upon the minds of the people more fully, we herewith append a schedule of valuation which has been fixed:

Fruit trees, first year, \$15 per acre; second, \$20; third, \$30; fourth, \$40; fifth, \$50.

Citrus trees, first year, \$50 per acre; second, \$75; third, \$100; fourth, \$125; fifth, \$150; sixth, \$200; seventh, \$225; eighth, \$250; ninth,

\$275; tenth, \$300; eleventh, \$325; twelfth, \$350; thirteenth, \$375; fourteenth, \$400.

Vines, first year, \$15 per acre; second, \$20; third, \$35; fourth, \$40; fifth, \$50.

Horticulture is a business that should receive every encouragement, instead of its progress being blocked by such an unjust tax. In other countries a bonus for every acre set out to fruit is paid by the government. Thus the importance of horticulture is apparent, and the bonus offered stimulates new plantings. It is conceded that horticulture aids in the development of the State and enhances its wealth; then why not encourage the industry that makes it so?

#### INVESTIGATIONS.

During the year several bulletins, giving the results of investigations carried on by the Board, have been published; others are now in course of preparation.

#### PARASITES AND BENEFICIAL INSECTS.

The Legislature of 1891 passed an Act entitled "An Act to appropriate \$5,000, for the purpose of sending an expert to Australia, New Zealand, and adjacent countries, to collect and import into this State parasites and predaceous insects," approved March 31, 1891, and confided to our care the expenditure of said money. As soon as the Act became a law, we entered into an agreement with the late Secretary of Agriculture, J. M. Rusk, whereby we secured the services of Albert Koebele, an accredited agent of that Department, and who on a former mission discovered the *Vedalia cardinalis*, which achieved such wonderful results in ridding our citrus orchards of that formidable pest, the cottony cushion scale, which for a time threatened their very existence. Secretary Rusk, at our request, sent Mr. Koebele on this late mission and paid his salary, while we paid his expenses. He sailed for Australia on August 20, 1891, where he remained about a year, traveling from one country to another searching for parasites and beneficial insects. The following constitute the different species he there collected and sent to this State for propagation:

*Coccinella arcuata*, Fabr.  
*Coccinella conformis*, Boisd.  
*Coccinella antipodum*, White.  
*Coccinella Kingi*, MacLeay.  
*Coccinella repanda*, Thunb.  
*Neda testudinaria*, Muls.  
*Halzia galbula*, Muls.  
*Halzia poscoeii*, Crotch.  
*Halzia edwardsi*, Muls.  
*Verania frenata*, Er.  
*Verania lineola*, Fabr.  
*Orcus chalybeus*, Boisd.  
*Orcus australasia*, Boisd.  
*Orcus nummeralis*, Boisd.  
*Orcus bilunululatus*, Boisd.  
*Trichorcus cinctus*, Blackb.  
*Anisorcus affinis*, Crotch.  
*Cryptolaemus montrouzieri*, Muls.  
*Boculusourneti*, Muls.  
*Boculus convexus*, Blackb.  
*Platyoninus lividigaster*, Muls.  
*Novius Koebelei*, Olliff.  
*Novius bellus*, Blackb.

*Scymnus whittonensis*, Blackb.  
*Scymnus queenslandicus*, Blackb.  
*Scymnus australasiz*, Blackb.  
*Rhizobius boucardi*, Crotch.  
*Rhizobius ventralis*, Erich.  
*Rhizobius debilis*, Blackb.  
*Rhizobius satellus*, Blackb.  
*Rhizobius fugax*, Blackb.  
*Rhizobius dorsalis*, Blackb.  
*Rhizobius cyaneus*, Blackb.  
*Rhizobius speculifer*, Blackb.  
*Rhizobius toowoombæ*, Blackb.  
*Rhizobius aurantii*, Blackb.  
*Rhizobius cæcus*, Blackb.  
*Rhizobius (hirtellus)*, Crotch?  
*Rhizobius pulcher*, Blackb.  
*Rhizobius australis*, Blackb.  
*Midus pygmaeus*, Blackb.  
*Lipernes subviridis*, Blackb.  
*Gymnoscymnus minutus*, Blackb.  
*Cyrema rigellum*, Blackb.  
*Serangium hirtuosum*, Blackb.  
*Serangium maculigerum*, Blackb.



*Erithionyx lanosus*, Blackb.  
*Scymnoides Koebelei*, Blackb.  
*Scymnus notescens*, Blackb.  
*Scymnus flavifrons*, Blackb.  
*Scymnus Sydneyensis*, Blackb.

*Thalpochares cocciphaga*, Meyr, *Thalpochares* sp., and three other Tineids.  
*Diplosis Koebelei*, Skuse, MS.  
*Lestophonus iceryæ*, Skuse.

Besides the above, many other as yet undescribed species were received from him. Some of them give great promise of ridding the orchards of this State of some of the most formidable pests that attack them. The *Orcus chalybeus*, at Los Angeles, increased to such an extent that an agent had to be appointed to prevent them from being carried away by curiosity-seekers and others, perhaps too enthusiastic of the ultimate results of same as scale destroyers, thereby lessening their numbers and preventing reproduction of the species for colonization. The *Rhizobius ventralis*, an insect preying on the black scale, has increased to many millions, from not more than twenty insects. It is now an established fact that they are equally as important for the destruction of the black scale as the *Vedalia cardinalis* proved for the cottony cushion scale. While the latter scale confined its attacks to citrus trees principally, the black scale attacks almost every tree and plant known; and while it does not thrive in sections where the air is dry and the heat of summer ranges above 90° F., along the coast and bay counties it has been one of the most troublesome pests the fruit raisers have had to combat. The functions of the *Vedalia cardinalis* and the work it has accomplished were without precedent, and for this reason entomologists claimed a repetition of it in the case of the recently imported species would be impossible. That the work the *Vedalia* accomplished was without precedent is true, but in the recently imported species, two of them—*Rhizobius ventralis* and *Novius Koebelei*—also proved their value as scale destroyers, and in that respect equaled the *Vedalia* and thus showed the wide field that lies open for future investigation in this line. The *Novius* preys on the cottony cushion scale, and while we already have an enemy for this scale in the *Vedalia*, it cannot but prove a valuable ally. The *Rhizobius ventralis* promises to be of more importance, because it attacks all the scales of the *Lecanium* family, of which there are many infecting our orchards. The *Rhizobius ventralis* was received in June, 1892, and placed in an orchard in Santa Barbara, infested with black scale. In September of that year their increase began to be noticed, but this increase was necessarily slow, as the original stock consisted of only about twenty insects. In the spring of 1893 their increase was noted at a greater ratio, and by summer they had increased to many millions, and destroyed the scale on the trees wherever they were placed. So complete was their work and so satisfactory, that in September the distribution of colonies began. Their distribution was discontinued on October 16th, after having sent out 453 colonies of from 25 to 50 beetles each. Other distributions will be made in the spring of 1894. There are now more than five hundred applications on file. Those distributed were as follows:

Alameda.....	1	Lamanda Park.....	6	San Diego.....	14
Alhambra.....	12	La Mesa.....	1	San Dimas.....	3
Anaheim.....	8	Linda Vista.....	1	San Francisco.....	8
Azusa.....	10	Livermore.....	1	San Gabriel.....	17
Ballard.....	1	Long Beach.....	1	San José.....	5
Berkeley.....	1	Los Angeles.....	67	San Leandro.....	1
Buena Park.....	2	Martinez.....	1	San Lorenzo.....	1
Cahuenga.....	1	Mission San José.....	1	San Luis Obispo.....	3
Calistoga.....	1	Monrovia.....	1	San Rafael.....	2
Carpenteria.....	3	Montecito.....	4	Santa Ana.....	5
Centerville.....	3	Monterey.....	1	Santa Barbara.....	37
Chula Vista.....	2	Mountain View.....	2	Santa Clara.....	4
Claremont.....	1	Napa.....	1	Santa Cruz.....	8
Colegrove.....	4	National City.....	6	Santa Maria.....	5
College City.....	1	New Jerusalem.....	1	Santa Monica.....	6
Colton.....	1	Niles.....	5	Santa Paula.....	4
Compton.....	1	Nordhoff.....	2	Saticoy.....	5
Covina.....	16	Occidental.....	1	Sespe.....	1
Del Mar.....	1	Oceanside.....	1	Sierra Madre.....	4
Downey.....	3	Olive.....	2	St Helena.....	1
Duarte.....	6	Ontario.....	26	Summerland.....	1
El Modena.....	1	Orange.....	3	Suñol.....	1
Fairview.....	1	Pala.....	2	Sunnyside.....	1
Fallbrook.....	4	Pasadena.....	11	Trenton.....	1
Fillmore.....	5	Piru.....	2	Tropico.....	2
Fullerton.....	3	Placerville.....	1	Tustin.....	4
Glendale.....	1	Pomona.....	19	Twin Oaks.....	1
Goleta.....	4	Prospect Flat.....	1	Ventura.....	6
Grass Valley.....	1	Puente.....	1	Verdugo.....	2
Haywards.....	1	Rainbow.....	1	Vernondale.....	4
Helena.....	1	Rivera.....	7	Villa Park.....	1
Helix.....	1	Riverside.....	4	Whittier.....	2
Hollister.....	1	Sacramento.....	1	Yorba.....	1
Jamul.....	1	San Bernardino.....	3		

The cost of this investigation was but a trifle in comparison with the value these insects will eventually prove to the State.

The following are the expenditures incurred; all vouchers and itemized bills are on file in the office of the State Controller:

1891—Oct. 31—Voucher No. 1.....	\$395 25
Oct. 31—Voucher No. 2.....	380 68
Nov. 30—Voucher No. 3.....	313 43
Dec. 28—Voucher No. 4.....	236 87
1892—Jan. 25—Voucher No. 5.....	297 54
Feb. 29—Voucher No. 6.....	312 00
Mar. 21—Voucher No. 7.....	297 47
Apr. 25—Voucher No. 8.....	365 52
Aug. 4—Voucher No. 9.....	918 12
Sept. 26—Voucher No. 10.....	131 65
Cost of transmitting funds:	
Voucher No. 11.....	24 75
Voucher No. 12.....	10 00
Voucher No. 13.....	15 00
Voucher No. 14.....	13 90
Cost of illustrating report—Voucher No. 15.....	625 00
Total.....	\$4,337 18
Balance unexpended.....	662 82

This amount (balance) has been returned to the State Treasurer, as is shown by certificate (No. 163) from Controller's office.

The report on this mission, made to the Board by Albert Koebele, was published in pamphlet form in December, 1892, of which ten thousand copies were printed. Said report also appears in the proceedings of the San José Convention in this volume. An extra set of the colored plate illustrating some of the species in the pamphlet was ordered printed and appears in the present report, as also cuts illustrating the *Rhizobius ventralis* in various stages, and an extra plate of our most common species, as well as those of former introduction.

The following is a supplemental report by Mr. Koebele:

*To the honorable State Board of Horticulture:*

GENTLEMEN: My expenses on my first trip to Australia were light and less than on my last trip, for the following reasons: My work of the first trip consisted only in searching for and introducing the natural enemies of the *Icerya purchasi*, which were found in numbers in and near cities. During the most of my time then I remained at Adelaide, at which place the chief work had to be done, and there I stayed at a private boarding-house. As a Commissioner for the Melbourne Exposition, I had free passes over the roads of New South Wales, Victoria, and South Australia during the entire time of my work, consisting of four months. Many of the items, such as cab fare, etc., were not allowed by the regulations of the Commissioners, and the same were paid out of my private funds. The expenses for the last trip were necessarily heavier, for this reason: I went on my second mission to study and collect such parasitic and predaceous insects as would be of benefit to the fruit growers here. I distinctly understood from you that nothing should be left undone to make the work a success, regardless of expense. It became necessary to visit all parts accessible, and all beneficial insects had to be bred to become properly familiar with their habits and natural enemies, in consequence of which I had to keep a room in which to do this work, at an extra expense. During a great part of the time I was unable to get my meals at the hotel at which I stayed and paid for same, on account of the pressing work. It was generally at long distances from the railroad stations that the field work and collecting had to be done; and in order to save time and health, cab hire had to be resorted to. Without the necessary conveniences and proper living it would have been impossible for me to have done the work accomplished.

Yours respectfully,

ALBERT KOEBELE.

ALAMEDA, CAL., November 9, 1893.

Our agent while traveling abroad was well received everywhere, and great kindness shown him, for which we feel grateful. In turn we have aided those countries in every way possible.

#### INTRODUCTION OF THE *VEDALIA* INTO SOUTH AFRICA.

We supplied the government of South Africa with colonies of *Vedalia*, which in a few months cleaned out the cottony cushion scale in the orchards, thereby doing for the Cape what Australia did for us a few years ago, in giving us the *Vedalia*, which saved the citrus industry from ruin by that formidable pest.

The following extracts from Mr. Louw's report on his California mission will no doubt prove of interest:

SIR: In order to carry out the instructions contained in your letter to me dated September 16, 1891, I left for the United States on the same date in the "Moor," and arrived at New York on the morning of November 6, 1891.

"To the Honorable J. W. SAUER, Colonial Secretary:

"Your instructions to me were:

"First—To obtain a supply of the California beetle, called the *Vedalia cardinalis*." \*\*\* I left for California, touching en route and stopping at Philadelphia, Chicago, and Denver, and arrived at San Francisco on November 24th.

On the morning of the 25th I went to see Mr. B. M. Lelong, the Secretary of the State Board of Horticulture, and was surprised to find, upon my mentioning the *Vedalia* to him, that he could immediately supply me with a colony, and more should I require it.

The State Board of Horticulture keep in their offices at San Francisco a regular stock of *Vedalia*, and also propagate them there, and they supply the various demands to the State and elsewhere. I then made arrangements with the Secretary to forward by express for New York one box containing the *Vedalia*, and another box containing a supply of food, for my journey homeward, upon his receiving a telegram from me from Los Angeles, which place I had to visit.

I left San Francisco on December 6th, and arrived at Los Angeles on the evening of the 7th. \* \* \*

Having now obtained the supply of *Vedalia*, I fixed upon the 23d of December as the date of my departure from New York, and I wired to Mr. Lelong at San Francisco to that effect, in order to enable him to forward me his supply of *Vedalia*, as promised, in time, which he did.

With a supply of living scale carefully packed in a separate box, under the direction of Mr. Lelong, I was enabled during the voyage home, which extended to about thirty-five days, to feed both the boxes of *Vedalia*, and with careful management on the 29th



of January, 1892, succeeded in handing them over to the Secretary of the Agricultural Department here in a perfect condition.

I trust that as my mission in this respect has been crowned with success, the Colony may within a very limited time reap the benefit of it.

Mr. Louw reports extensively upon many other investigations made by him, and concludes his report as follows:

I desire especially to mention the National Agricultural Department at Washington, and Mr. B. M. Lelong, the Secretary of the State Board of Horticulture, at San Francisco, Cal.; to both above mentioned I desire you will, on behalf of our Government, express to them your appreciation of the services rendered to me.

MALMESBURY, 1st February, 1892.

THOMAS A. J. LOUW.

#### INSPECTION OF STEAMSHIPS.

As new insects are continually appearing, also fungi not before observed, in different countries, and trees from those countries are being imported every year into our State, and as the inroads already made by these enemies to fruit culture there are a serious loss to the growers and have made it almost impossible for them to continue the business, we have caused the inspection of every steamship arriving from foreign countries, to prevent their possible introduction into this State. The following list comprises the number of vessels arriving at the port of San Francisco inspected during the year, upon which trees and plants were found:

Date.	Vessel.	From Where.	No. Plants on Board.	No. Trees.	Action Taken.
1893.					
Jan. 5	Columbia	China and Japan	1 case	35 bundles	Passed.
Jan. 9	Rio de Janeiro	Honolulu	2 cases	40	Destroyed.
Jan. 11	Australia	China and Japan	31 cases	2,525	Passed.
Jan. 12	Gaelic	Oregon	1 box	4 bundles	Disinfected.
Jan. 13	Panama	Central America	1 case	1 bundle	Passed.
Jan. 19	Mariposa	Australia	33 cases, 2-490 plants.	710	Passed.
Feb. 1	China	China and Japan	14 cases, 2-340 plants.		119 destroyed, rest passed.
Feb. 6	City of Peking	Honolulu	2 cases		Disinfected.
Feb. 9	Australia	Central America	1 case		Passed.
Feb. 15	City of Panama	Oregon	1 case	8 bundles	Passed.
Feb. 15	Queen	Australia	1 case		Passed.
Feb. 17	Monowai	China and Japan	28 cases, 40,000 plants.	5,000	240 destroyed, rest disinfected.
Feb. 18	Belgic	China and Japan	44 cases, 11,145 plants.	5,750	350 destroyed, rest disinfected.
Mar. 4	Oceanic	Central America	1 case		Passed.
Mar. 6	City of Sydney	Honolulu	3 cases		Passed.
Mar. 8	Australia	China and Japan	17 cases, 950 plants.	1,000	200 destroyed, rest disinfected.
Mar. 15	Rio de Janeiro	Australia	8 cases		Passed.
Mar. 16	Alameda	China and Japan	Plants and trees for World's Fair.		Passed.
Mar. 23	Gaelic	Central America	1 case		Passed.
Mar. 24	San Juan	Japan	78 cases		Disinfected.
Mar. 28	P. C. Steamer	Honolulu	1 case		Passed.
Apr. 5	Australia	Australia	5 cases		Disinfected.
Apr. 14	Mariposa	China and Japan	14 cases		Disinfected.
Apr. 15	China	China and Japan	60 cases		Disinfected.
Apr. 22	Belgic	Central America	1 case		Passed.
Apr. 24	City of Sydney				

Date.	Vessel.	From Where.	No. Plants on Board.	No. Trees.	Action Taken.
May 2	Peru .....	China and Japan	7 cases, 1-215 plants.	-----	Passed.
May 3	Australia .....	Honolulu .....	Few ferns	-----	Passed.
May 4	Harvester .....	Honolulu .....	50 tree ferns	-----	Passed.
May 4	San Blas .....	Central America.	4 palms	-----	Passed.
May 6	Acapulco .....	Central America.	A few caladiums, etc.	-----	Passed.
May 15	San Juan .....	Central America.	1 case banana plants.	-----	Passed.
May 16	Oceanic .....	China and Japan.	1 case	-----	Destroyed.
May 20	Rio de Janeiro..	China and Japan.	A few conifer plants.	-----	Clean.
May 25	City of New York	Central America.	A few ornamental plants.	-----	Clean.
May 31	Australia .....	Honolulu .....	Few plants	-----	Destroyed.
June 6	Gaelic .....	China and Japan.	-----	2 packages orange trees.	Destroyed.
June 8	Alameda .....	Australia .....	1 case ferns	-----	Clean.
June 18	City of Peking..	China and Japan.	1 case	-----	Disinfected.
June 26	China .....	China and Japan.	11 cases	-----	9 destroyed, rest disinfected.
June 28	Australia .....	Honolulu .....	1 box plants	1 box banana plants.	Plants destroyed; banana plants clean.
July 5	Belgic .....	China and Japan.	1 case plants	-----	Clean.
July 6	Mariposa .....	Australia .....	5 cases ferns, etc.	-----	Clean.
July 8	City of Papette..	Tahiti .....	Few coconut trees.	-----	Clean.
July 15	Peru .....	China and Japan.	1 basket of plants.	-----	Clean.
July 24	San Juan .....	Central America.	1 cocoa tree	-----	Clean.
July 25	Oceanic .....	China and Japan.	1 case conifer.	-----	Clean.
July 26	Australia .....	Honolulu .....	Passengers had a few trees.	-----	Clean.
Aug. 2	Rio de Janeiro..	China and Japan.	Passengers had a few trees.	-----	6 destroyed.
Aug. 4	Monowai .....	Australia .....	1 case plants	Flying fox	Plants disinfected; flying fox killed.
Aug. 15	Gaelic .....	China and Japan.	1 case	-----	1 plant destroyed.
Aug. 23	Australia .....	Honolulu .....	-----	1 case banana plants.	Clean.
Aug. 23	City of Peking..	China and Japan.	Few plants.	-----	Clean.
Aug. 31	China .....	China and Japan.	Few plants.	-----	Clean.
Aug. 31	Alameda .....	Australia .....	3 cases	-----	Disinfected.
Sept. 9	Belgic .....	China and Japan.	Passengers had a few plants.	-----	Clean.
Sept. 11	Tropic Bird .....	Tahiti .....	1 case bulbs	-----	-----
Sept. 15	Newbern .....	Mexico .....	1,157 boxes oranges.	-----	110 boxes destroyed; fumigated. rest
Sept. 19	Peru .....	China and Japan.	Few plants.	-----	Clean.
Sept. 20	Australia .....	Honolulu .....	6 plants	-----	1 destroyed.
Sept. 28	Colima .....	Central America.	1 case palms	-----	Clean.
Sept. 28	Mariposa .....	Australia .....	4 cases	-----	Disinfected.
Oct. 4	Oceanic .....	China and Japan.	A few plants	-----	Clean.
Oct. 10	Rio de Janeiro..	China and Japan.	Few plants; 4 flying foxes	-----	Plants clean; foxes killed.
Oct. 12	San José .....	Central America.	A few palms	-----	Clean.
Oct. 16	City of New York	China and Japan.	3 sago palms	-----	Clean.
Oct. 17	Acapulco .....	Central America.	5 coconut plants.	-----	Clean.
Oct. 18	Australia .....	Honolulu .....	-----	3 bxs. pineapple and banana plants.	Clean.

Date.	Vessel.	From Where.	No. Plants on Board.	No. Trees.	Action Taken.
Oct. 24	Gaelic -----	China and Japan.	2 cases -----	3 cases -----	250 fruit trees destroyed; rest disinfected.
Oct. 27	Monowai -----	Australia -----	1 case -----	-----	Disinfected.
Oct. 28	Colon -----	Central America.	1 cocconut palm.	-----	Clean.
Nov. 2	City of Peking..	China and Japan.	4 cases pl'nts for Mexico	-----	-----
Nov. 13	China -----	China and Japan.	3 cases palms	-----	Clean.
Nov. 18	Australia -----	Honolulu -----	3 bxs. plants	-----	Destroyed.
Nov. 19	Belgic -----	China and Japan.	-----	-----	-----
Nov. 23	Alameda -----	Australia -----	1 case ferns	-----	Clean.
Nov. 29	Peru -----	China and Japan.	2 cases -----	-----	Passed.
Dec. 6	Tropic Bird -----	Tahiti -----	A few cocconut palms.	-----	Clean.
Dec. 13	Oceanic -----	China and Japan.	25 cases plants.	-----	Disinfected.
Dec. 15	Australia -----	Honolulu -----	Palm leaves for Mid-winter Fair	-----	Disinfected.

Total number of vessels on which plants and trees were found, 156. This is only those containing trees and plants, the total number of vessels inspected being over 400.

Besides plants and trees, five flying foxes (vampires), which have proved so destructive to fruit in Australia, were found and killed. The flying fox has proved such a menace to fruit culture there that all sorts of means have been employed for their extermination, but as yet without avail. A cut of same is herewith attached (Plate IV).

The Southern Pacific Company, and Wells, Fargo & Co., notify this office of the arrival of trees and plants, at their different stations and offices, and have instructed their agents not to deliver them to the owners until inspected by our officers.

#### EXPENDITURES.

The following report shows the amount of work transacted by this Board and the condition of its affairs, as well as to what purpose the funds for its use have been expended, viz:

Your Executive Committee met April 27, 1893. The first examination was of all vouchers which have been received, and which were on file from our last report. We compared each one separately with the entries upon the books, and found them absolutely accurate, without a mistake. Subsequently, we took each bill and compared it with the entries in the day book; there we found every item accounted for. Subsequently to that we examined the books and found each separate department classified, and these different accounts coincided to a cent with the report as made by the Secretary, all being verified.

The first department was stenography .....	\$201 20
Traveling expenses of Commissioners, during the 10 months .....	460 75
Experimenting, including all appliances, etc. ....	167 97
Office furniture .....	284 05
(Which we examined and found correct in detail).	
Papers for the office .....	22 60
Additions to Library .....	128 50
Services of Janitor .....	132 00
Postage .....	572 40
(For the 10 months past. It was calculated by the Board that the postage would amount to \$105 per month, and instead it has cost \$572 40 for ten months.)	
Cartage .....	86 51
Freight .....	26 19
Expressage .....	101 70



Wood cuts and electrotypes .....	\$17 75
Lithographing .....	490 00
Miscellaneous printing .....	34 25
Office boy .....	145 00
Salaries of Special Agents .....	1,671 66
(Which includes all the compilation of the Report of 1892, outside of what was done by the Secretary, and the items were: four and one half months' services of Mr. Isaac, \$675; Mr. Allen's services, two months, \$300; Mr. Hewitt's services, \$490 66, and Mr. Brainard's, \$200, which is outside of the office.)	
Traveling expenses Special Agents (in securing the material for the report) .....	62 95
Traveling expenses of Quarantine Officer .....	294 35
Traveling expenses of Deputy Quarantine Officer (Mr. Ehrhorn) .....	91 05
Traveling expenses of Secretary .....	196 50
All the copying outside of the office .....	85 00
Sketches and drawings .....	394 82
(Which includes frontispiece of last report, two maps, and Mr. Koebele's report.)	
Office supplies .....	147 20
Sundries .....	327 25
Rent .....	1,215 00
Telegrams .....	31 05
Salary Deputy Quarantine Officer .....	223 50
Sixteenth Fruit Growers' Convention (including rent of hall, etc.) .....	204 00
Repairing and improvements in offices .....	175 40
Making a total of .....	\$8,690 55
Leaving a balance of .....	1,309 45
All of which coincides with the report of the Secretary, and completes the report of Executive Committee.	
Respectfully submitted,	

J. L. MOSHER,  
FRANK A. KIMBALL,  
ELLWOOD COOPER,  
Executive Committee.

The following are the expenditures for the forty-fourth fiscal year ending June 30, 1893:

Stenographer .....	\$201 20
Traveling expenses Commissioners .....	628 25
Experimenting .....	209 67
Office furniture .....	301 15
Papers .....	30 40
Library .....	129 50
Janitor .....	177 00
Postage .....	772 50
Cartage .....	95 63
Freight .....	26 19
Expressage .....	106 65
Wood cuts and electrotypes .....	17 75
Lithographing .....	490 00
Miscellaneous printing .....	111 65
Office boy .....	145 00
Special Agents, salary .....	1,771 66
Special Agents, traveling expenses .....	762 95
Quarantine Officer, traveling expenses .....	324 25
Deputy Quarantine Officer, salary .....	304 25
Deputy Quarantine Officer, traveling expenses .....	91 05
Secretary, traveling expenses .....	279 70
Copying .....	85 00
Sketches and drawings .....	403 46
Office supplies .....	157 05
Sundries .....	340 45
Rent .....	1,620 00
Telegrams .....	32 85
Expenses Sixteenth Convention (San José) .....	204 00
Repairing .....	175 40
Total .....	\$9,996 21
State appropriation .....	10,000 00
Balance .....	\$3 79
Balance from forty-third fiscal year .....	18
Total balance, June 30, 1893 .....	\$3 97

The expenditures for the present forty-fifth fiscal year, commencing July 1, 1893, to December 30, 1893, are as follows:

Stenographer.....	\$170 00
Traveling expenses Commissioners .....	129 05
Papers .....	23 30
Library .....	51 25
Janitor .....	95 00
Postage .....	63 75
Cartage .....	34 13
Freight .....	16 18
Wood cuts and electrotypes .....	260 64
Lithographing .....	150 00
Miscellaneous printing .....	105 40
Special Agent, salary .....	524 50
Special Agent, traveling expenses .....	87 25
Traveling expenses Quarantine Officer .....	239 75
Traveling expenses Deputy Quarantine Officer .....	20 40
Traveling expenses Secretary .....	127 00
Sketches and drawings .....	378 64
Office supplies .....	114 78
Rent .....	700 00
Telegrams and telephone .....	71 45
Salary Deputy Quarantine Officer .....	39 00
Repairing .....	12 40
Expressage .....	64 90
Experimenting .....	114 25
Midwinter Fair exhibit .....	621 76
Sundries .....	110 30
Seventeenth State Convention .....	168 35
 Total .....	 \$4,493 43
State appropriation .....	10,000 00
 Balance unexpended .....	 \$5,506 57

*To the honorable State Board of Horticulture:*

Your Executive Committee has examined the books in full, and find the same correct, and the above report corresponds with the ledger, day book, and vouchers.

J. L. MOSHER,  
Chairman.

#### QUARANTINE REGULATIONS.

(Amended December 28, 1893.)

In order to more properly protect the State from the introduction of formidable pests and diseases, the following regulations were issued:

**RULE I.** All consignees, agents, or other person or persons shall, within twenty-four (24) hours, notify the Quarantine Officer of the State Board of Horticulture, or a duly commissioned Quarantine Guardian, of the arrival of any trees, plants, buds, cions, seeds, or pits, at any point of debarkation in the State of California.

**RULE II.** All trees, plants, cuttings, grafts, buds, cions, seeds, or pits imported or brought into the State from any foreign country, or from any of the United States or Territories, are hereby required to be disinfected, as hereinafter provided, upon arrival at any point where they are to be unloaded; and, furthermore, if any of said trees, plants, cuttings, grafts, buds, cions, seeds, or pits are found infested with insects, or with any fungi, blight, or other diseases injurious to fruit or to fruit trees, or to other trees or plants, they shall remain in quarantine fourteen (14) days, or until the Quarantine Officer of the State Board of Horticulture, or a duly commissioned Quarantine Guardian, can determine whether the said trees, plants, cuttings, grafts, buds, cions, seeds, or pits are free from live injurious insect pests or their eggs, larvæ, or pupæ, before they can be offered for sale, gift, distribution, or transportation.

**RULE III.** All trees, plants, cuttings, grafts, buds, cions, seeds, or pits infested with any insects, fungi, blight, or other diseases known to be injurious to fruit or to fruit trees, or to other trees or plants, and liable to spread contagion, are hereby required to be disinfected before being offered for sale, gift, removal, distribution, or transportation.

**RULE IV.** All peach, nectarine, apricot, plum, almond, or other trees budded or grafted upon peach stocks or roots, and all peach or other pits, cuttings, buds, or cions, raised or grown in a district where the "Peach Yellows" or the "Peach Rosette" are known to exist, are hereby prohibited from being planted or offered for sale, gift, or distribution within the State of California.

**RULE V.** All trees, plants, cuttings, grafts, buds, cions, pits, or seeds arriving from any foreign country found infested with insect pests or their eggs, larvæ or pupæ, or with fungi or other disease or diseases hitherto unknown in this State, are hereby prohibited from landing.

**RULE VI.** Fruit of any kind grown in any foreign country, or in any of the United States or Territories, found infested with any insect or insects, or with any fungi, blight, or other disease or diseases injurious to fruit or to fruit trees, or to other trees or plants, are hereby prohibited from being offered for sale, gift, or distribution within the State.

**RULE VII.** Transportable material of any kind infested by any insect or insects, or their eggs, larvæ, or pupæ, or by any fungi, blight, or other disease or diseases known to be injurious to fruit or to fruit trees, or to other trees or plants, and liable to spread contagion, is hereby prohibited from being offered for sale, gift, distribution, or transportation, until said material has been disinfected by dipping it in boiling water and allowing it to remain in said boiling water not less than two minutes; such boiling water used as such disinfectant to contain in solution one pound of concentrated potash to each and every ten gallons of water.

**RULE VIII.** All trees, plants, cuttings, grafts, buds, cions, seeds, or pits may be disinfected by dipping in a solution of three fourths of a pound of whale-oil soap (80 per cent) to each and every gallon of water; said whale-oil soap solution shall be kept at a temperature of 100° to 115° Fahrenheit. Said trees, plants, cuttings, grafts, buds, cions, seeds, or pits shall remain in said solution not less than two minutes. After said trees, plants, cuttings, grafts, buds, cions, seeds, or pits have been disinfected, they shall remain in quarantine fourteen (14) days for subsequent inspection, and if deemed necessary by the Quarantine Officer of the State Board of Horticulture, or a duly commissioned Quarantine Guardian, for further disinfection.

**RULE IX.** All trees, plants, cuttings, grafts, buds, cions, seeds, or pits may be disinfected by fumigation with hydrocyanic acid gas, as follows: Said trees, plants, cuttings, grafts, buds, cions, seeds, or pits shall be covered with an air-tight tent, or box, and for each and every 100 cubic feet of space therein one ounce of fused cyanide of potassium (58 per cent), one fluid ounce of sulphuric acid, and two fluid ounces of water shall be used. The cyanide of potassium shall be placed in an earthenware vessel, the water poured over the said cyanide of potassium, afterwards adding sulphuric acid, and the tent, or box, to be immediately closed tightly, and allowed to remain closed for not less than forty minutes. After said trees, plants, cuttings, grafts, buds, cions, seeds, or pits have been treated with hydrocyanic acid gas, as above directed, they shall remain in quarantine for fourteen (14) days for subsequent inspection, and if deemed necessary by a member of the State Board of Horticulture, or the Quarantine Officer of said Board, or a duly commissioned Quarantine Guardian, for subsequent disinfection.

**RULE X.** All trees, plants, cuttings, grafts, buds, cions, seeds, or pits imported or brought into this State shall be inspected upon arrival at first point of debarkation, and if found infested with injurious insects which cannot be destroyed by the remedies required in Rules VIII and IX of these regulations, are hereby prohibited from sale, gift, or distribution, and shall be proceeded against as a nuisance.

**RULE XI.** Any person or persons having in their possession trees, plants, cuttings, grafts, buds, cions, seeds, or pits infested with any insect or insects, or with any fungi, blight, or other disease or diseases injurious to fruit or to fruit trees, or to other trees or plants, and who refuse or neglect to disinfect the said trees, plants, cuttings, grafts, buds, cions, seeds, or pits, as is required by Rules VIII and IX of these regulations, after having been notified to do so by a member of the State Board of Horticulture, the Quarantine Officer of said Board, or a duly commissioned Quarantine Guardian, the said trees, plants, cuttings, grafts, buds, cions, seeds, or pits shall be declared a public nuisance, and shall be proceeded against as provided by law.

#### DUSTING SULPHUR MACHINE.

One of the most important inventions made during the year is an apparatus for distributing sulphur on trees, especially where infested by fungus, mildew, or mites. It was invented by George F. Ditzler, Superintendent of the Hatch & Rock orchards at Biggs. An illustration of it and its different parts is herewith attached (Plate V), from which any one can build such an apparatus.

#### EXHIBIT AT MIDWINTER FAIR.

With a view of showing the people the work this Board has set out to do, we have undertaken to make, at the International Midwinter Fair, which opened in San Francisco January 1, 1894, a collective horticultural exhibit, in its different branches, to which we invite attention. In



this undertaking we have received the cordial support of the fruit growers of our State, which we hereby publicly acknowledge. (See Frontispiece.)

#### EXPERIMENTS.

Experiments and investigations are constantly being made, the results of which are published in bulletins from time to time, as occasion requires, and widely distributed throughout the State.

#### OFFICES OF THE BOARD.

The offices of the Board are large and commodious, and are recognized as the headquarters for fruit growers. Here the seekers of information can find the office open every day. We keep on file reports from all horticultural societies of the land, and in addition our library contains books on fruit growing nowhere else to be found. It is the largest horticultural library on the Pacific Coast.

Respectfully submitted.

ELLWOOD COOPER,  
L. W. BUCK,  
FRANK A. KIMBALL,  
J. L. MOSHER,  
A. BLOCK,  
FRED C. MILES,  
SOL. RUNYON,  
I. H. THOMAS,  
A. F. WHITE,  
Commissioners.

B. M. LELONG,  
Secretary and Chief Horticultural Officer.

Subscribed and sworn to before me, at San Francisco, Cal., December 30, 1893.

[Seal.]

A. K. DAGGETT,  
Notary Public in and for the City and County of San Francisco, State of California.

## EXPLANATION OF PLATE.

### BENEFICIAL INSECTS.

(PLATE I.)

- Fig. 1. Steel-blue Ladybird (*Orcus chalybeus*)—female, enlarged.  
1a. Steel-blue Ladybird—head and prothorax, male, enlarged.  
1b. Steel-blue Ladybird—female, natural size.  
2. Six-spotted Orcus (*Orcus australasia*)—female, enlarged.  
2a. Six-spotted Orcus—female, natural size.  
3. Koebele's Ladybird (*Novius Koebelei*)—male, enlarged.  
3a. Koebele's Ladybird—male, natural size.  
3b. Koebele's Ladybird—female, natural size.  
3c. Koebele's Ladybird—larva, enlarged.  
3d. Koebele's Ladybird—larva, natural size.  
4. Branch with Cottony Cushion Scale and larvæ of *Novius Koebelei*, natural size.  
4a. Cottony Cushion Scale (*Icerya purchasi*).  
4b. Larvæ of *Novius Koebelei* preying upon Cottony Cushion Scale.  
5. 22-Spotted Leis, *Coccinella* (Leis) *conformis*, enlarged.  
5a. 22-Spotted Leis—male, natural size.  
5b. 22-Spotted Leis—female, natural size.  
6. Black Scale Enemy (*Thalpochara coccophagus*), enlarged.  
6a. Black Scale Enemy, natural size.

## EXPLANATION OF PLATE.

### BENEFICIAL INSECTS.

#### (PLATE II.)

- Fig. 1. Pilate's Ladybird (*Exochomus Pilatei*).  
2. Twice-stabbed Ladybird (*Chilocorus bivulnerus*).  
3. Twice-stabbed Ladybird—larva.  
4. Eyed Ladybird (*Coccinella oculata*).  
5. *Hyperaspis lateralis*.  
6. 20-spotted Ladybird (*Psyllobora 20-maculata*).  
7. Brown-neck Ladybird (*Rhizobius Toowoombæ*).  
8. Australian Ladybird (*Vedalia cardinalis*).  
9. Australian Ladybird—larva.  
10. Australian Ladybird—pupa.  
11. Lace-winged Fly (*Chrysopa Californica*)—larva.  
12. Gray Soldier Bug (*Euschistus tristigmus*).  
13. Lace-winged Fly (*Chrysopa Californica*)—wings expanded.  
14. Lace-winged Fly (*Chrysopa Californica*)—at rest.  
15. Lace-winged Fly (*Chrysopa Californica*)—eggs as they are laid at the end of slender threads.  
16. Australian Ladybird (*Vedalia cardinalis*)—enlarged.  
17. Australian Ladybird (*Vedalia cardinalis*)—larva enlarged.  
18. Spine-legged Soldier Bug (*Sinea spinipes*).  
19. Brown Laced-wing Fly (*Hemerobius*).  
20. *Anatis subvittata*.  
21. California Ladybird (*Coccinella Californica*).  
22. Convergent Ladybird (*Hippodamia convergens*).  
23. Ambiguous Ladybird (*Hippodamia ambigua*).  
24. Julian's Banded Ladybird (*Coccinella trifasciata* var. *Juliana*).  
25. Blood-red Ladybird (*Coccinella sanguinea*).  
26. Striped Ladybird (*Megilla vittigera*).  
27. Ashy-gray Ladybird (*Coccinella abdominalis*).  
28. Two-spotted Ladybird (*Adalia bipunctata*).  
29. Cocoon of the Lace-winged Fly (*Chrysopa Californica*).  
30. Syrphus Fly (*Catabomba pyrastris*).





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Male, enlarged.



Female, enlarged.

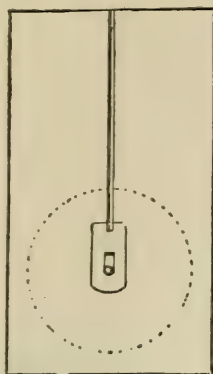
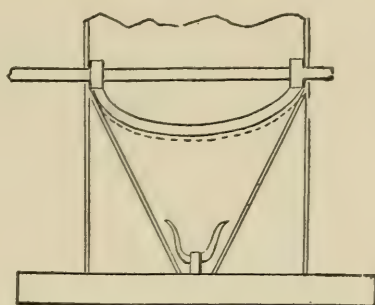
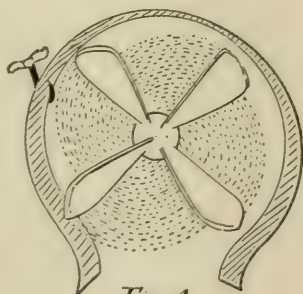
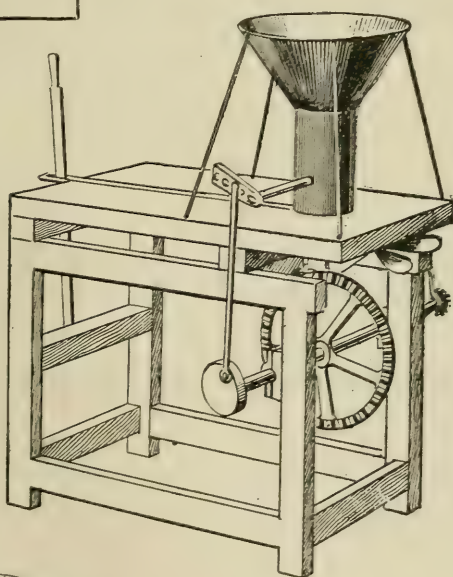
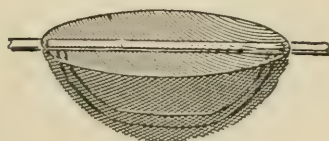


Larva, enlarged.





FLYING FOX (*Pteropus*). Spread of wings, 3 feet 2 inches. Length of body, 14 inches.

*Fig. 5**Fig. 2**Fig. 1**Fig. 4**Fig. 3.*

- Fig. 1. Machine complete.  
 Fig. 2. Shows position of screen agitator and funnel.  
 Fig. 3. Screen.  
 Fig. 4. Movable disk to regulate direction of cast.  
 Fig. 5. Slide to regulate quantity of sulphur.





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REPORT  
OF  
B. M. LELONG,

Secretary, and Chief Horticultural Officer.

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# REPORT OF B. M. LELONG,

Secretary, and Chief Horticultural Officer.

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## II.

### REVIEW OF THE FRUIT SEASON.

The severe financial depression which extended over the length and breadth of the United States during the past season naturally reached the fruit industry of our State, as it did all other industries, although in a much less degree than most others have been affected; and while we have to report a period of depression among our fruit growers, this extends no further than a falling off of their usual profits during the latter part of the season.

Early in the season the canners and driers, who had been dependent upon temporary accommodations from the banks to tide them over their busy season, and until returns from their pack could be realized, found that no money could be had from the bankers. All the financial institutions of the State, dreading the possibilities of runs upon them by their depositors, were calling in all available funds and making no new loans. Owing to this condition of affairs many of our fruit-preserving establishments were compelled to remain closed, while of those which did business the greater part put up but a portion of their usual pack. Of the principal canneries in the State but one half were running at the height of the fruit season, and these were run at one half, or less, their usual capacity. Not more than twenty-five of the fifty larger drying establishments were run, and these put up very much less than their usual pack.

In addition to this conservatism on the part of the banks in our own State, business in the East was demoralized, and jobbers were fearful about placing orders as they had theretofore done, and few contracts were made for future delivery. Eastern houses, which usually lay in their stock of dried fruit early in the season, have neglected to do so this year, owing to the instability of the market and the scarcity of money. This unusual condition of business in the East naturally increased the conservatism of our packers. Less effort was made to force their products on the market, and the fear was ever present that a buyer, when found, might not be responsible, and was liable to be caught in the general crash, in which case the packer and shipper would be the sufferer.

The result of this has been largely to compel the grower to cure his own product, and a very large part of the crop is still in the hands of the producers. This home-dried fruit will find its way to the local and Eastern markets during the year.

To the above-named causes for depression in the prices of fruit must be added the fact that the Eastern crop was unusually large, necessarily reducing the demand for the California product.



Considering all these causes working against the interest of our fruit producers, we may claim that after all it has been a prosperous season, and our orchardists have suffered much less from the financial crash than have those engaged in most other pursuits. Prices paid for green fruit have varied from \$18 to \$25 per ton for drying fruit, and from \$25 to \$35 for canning sizes. Dried fruits have ruled much lower in the market this season. Apricots quoted last season at 12 to 15 cents, have this year sold at  $7\frac{1}{2}$  to 10 cents. Peaches, which last year sold at 9 to 12 cents, this year dropped to 6 or 8 cents, and prunes fell from 7 to  $4\frac{1}{2}$  cents. Later in the season, however, prices advanced, and a better feeling prevailed in the market. Last season's pack of cured fruits is now exhausted, and the present season's pack has fallen below the usual quantity; and it is not improbable that those who have stock on hand will realize good prices.

There is another reason for supposing this in the changed condition of our fruit market, which the greater part of the growers do not yet comprehend. In the earlier period of our fruit production the yield was comparatively small and could easily be handled by a few speculators, who made contracts for the entire crop early in the season, and the grower realized on his product as soon as it was ready to handle, or even anticipated this. It was within the power and to the interest of the speculator, then, to control the entire output. Now the output is so much in excess of what it was at that period, that there is little danger to be apprehended of a shortage at any time, the speculator cannot readily corner the product, and it is now more to the interest of the jobber to leave the stock in the hands of the producer until there is a market for it. Hence, in the early season there is not so great a demand, and growers who do not fully comprehend the reason, and who have been accustomed to turning their crop into cash at once, become demoralized and are too apt to close out for what they can get, thereby lowering their own market; while those who wait realize good prices. Such is largely the case the present season: those who have held on to their packs are now realizing fair prices, with the market advancing and good prices promised in the near future.

While the limited demand on the part of the canners and driers for green fruit had naturally a very depressing effect on the market, this was not so severe as it would have been had not the growers been able to cure their products by drying. Had the entire output been forced upon an unwilling market, a crash would have resulted, from which it is doubtful whether we should have recovered for many years, if at all. Fortunately our growers had a means of escape, and in their ability to cure their product saved themselves from heavy losses. As the old stock of dried fruit is now well out of hand and comparatively little of the new pack has yet found its way to market, the indications are that better prices will prevail, and those who have held their pack will realize good prices for it.

The packing establishments least affected by the monetary depression were those conducted on the coöperative plan. In these the packer and grower were practically the same person, and he could not be affected, as were those who had to purchase the fruit on speculation and take the chances on an uncertain market for its disposition. The loss to the coöperative packer lies in the difference between the prices received for his furnished product last season and this, and as he will be enabled to

hold his stock until the financial flurry has passed and the market becomes settled once more, it is probable that his loss will be nominal, if, indeed, a reaction does not come which will increase his profits.

With the exception of apricots, which are reported at not over one third to one half of a crop all over the State, the yield of various fruits this year has been above average, and the season a very propitious one.

Cherries generally yielded much more than the usual crop, and being a very early fruit, reached the Eastern and local markets at a time when fruit was in good demand, and netted its growers good prices.

Apricots were light, but those in the early market sold well, and prices kept up until about the middle of August, when they dropped and did not again recover.

Peaches were reported as very heavy in all sections. The early varieties brought good prices—from \$1 25 to \$1 50 per box. Later in the season these prices dropped, and the demand for canning and drying varieties was limited.

The prune crop was very large, and the quality more than usually good. But little of the crop has yet left the hands of the growers, but prices have been fair and are now improving. Altogether the season has been fairly good to the prune grower.

The plum crop was unusually large, and prices for this fruit were good. A heavy demand for Tragedy prunes sprang up and these brought very large figures.

The pear crop was fully up to the average, but prices not so good as usual. Pears and the later peaches came in conflict with the Eastern fruit crop, and the prices received a setback, from which it did not recover during the entire season.

The comparatively small demand for California fruits during the past season has once more revived the old question of over-production, and many suggestions have been made with a view to extending our present markets and opening new ones. I have given especial attention to this subject, and in the course of my investigations as to what extent we are supplying our home market, have prepared the following tables. These show only such fruits and fruit products as are produced in California. In round figures the United States is paying \$16,000,000 annually for fruits that California should produce and supply:

## REPORT OF STATE BOARD OF HORTICULTURE.

*Value of Fruits Imported in the past Decade and Conflicting with California Products.*

Year.	Plums and Prunes.		Figs.		Raisins.		Almonds.		Currants.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1884	60,600,228	\$2,632,838	7,945,977	\$512,063	53,702,220	\$3,290,150	3,898,104	\$547,619	---	---
1885	57,631,820	2,147,505	7,770,178	510,732	38,319,787	2,661,669	4,752,269	507,946	---	---
1886	64,995,545	2,026,595	7,233,070	505,876	40,387,946	2,885,123	5,822,733	647,077	---	---
1887	92,032,625	2,999,648	8,724,583	487,602	40,673,288	2,281,981	5,482,363	597,476	---	---
1888	70,626,027	2,197,150	10,058,053	469,755	40,476,763	2,070,120	5,747,957	631,748	---	---
1889	46,154,825	1,423,304	10,649,049	482,759	35,091,139	1,736,786	5,545,400	595,227	---	---
1890	58,093,410	1,789,176	10,284,998	456,567	36,914,330	1,997,103	5,715,858	813,278	---	---
1891	34,281,322	2,054,486	9,201,565	697,562	39,572,655	2,018,879	6,812,061	931,007	---	\$1,246,074
1892	10,869,797	437,271	8,338,759	511,142	20,687,640	964,369	7,629,392	36,665,828	---	1,209,119
1893	26,214,112	1,162,318	10,503,928	548,995	27,543,563	1,266,342	6,679,147	33,116,546	---	1,185,537
Year.	Olive Oil.		Oranges.		Lemons.		Preserved Fruits.		Nuts, other than Almonds.	
	Gallons.	Value.	Gallons.	Value.	Gallons.	Value.	Gallons.	Value.	Gallons.	Value.
1884	---	---	---	---	---	---	---	---	---	---
1885	493,928	\$672,552	610,429	\$2,901,228	2,088,204	\$2,088,747	555,048	\$687,185	---	\$2,469,054
1886	634,354	547,017	634,354	2,088,204	2,510,426	2,510,426	770,895	553,991	---	1,176,136
1887	744,766	662,197	744,766	1,871,839	2,608,819	2,608,819	833,557	563,727	---	1,450,842
1888	634,162	617,172	634,162	2,408,140	3,835,147	3,835,147	748,493	628,878	---	1,799,462
1889	893,338	696,065	893,338	2,268,872	3,395,983	3,395,983	941,302	743,668	---	1,968,798
1890	893,964	819,110	893,964	1,961,889	3,189,534	3,189,534	1,042,846	598,377	---	1,794,393
1891	605,509	733,489	605,509	1,916,658	3,374,032	3,374,032	954,331	800,376	---	1,777,286
1892	704,486	876,613	704,486	2,339,987	4,351,970	4,351,970	1,289,137	1,114,959	---	762,335
1893	697,052	891,424	697,052	1,210,338	4,548,263	4,548,263	1,234,828	821,200	---	538,300
									51,941	1,239,582

Year.

Olive Oil.

Oranges.

Lemons.

Preserved Fruits.

Nuts, other than Almonds.

Unclassified.



The articles enumerated in the table, except Zante currants, are dutiable. It is now proposed to remove or reduce the duty on many of them. What the ultimate effect of such action will have upon our fruit interests cannot be foretold, but the prospect is viewed with alarm by our growers, irrespective of party affiliation, and it has already had its effect in preventing the investment of new capital in the fruit industry.

In addition to the above there are some \$9,000,000 annually expended for fruit, nuts, and fruit products, which do not come directly in conflict with California products, and are admitted free of duty. These are chiefly bananas and cocoanuts, and the value of imports under this head for the past ten years is given below:

*Value of Fruits not Produced in California Imported in the Past Decade.*

Year.	Bananas.	Cocoanuts.	Dates.	Unclassified.
1884 -----	\$1,878,279	\$747,280	-----	\$874,615
1885 -----	2,156,873	714,512	-----	906,655
1886 -----	2,356,843	685,981	-----	881,970
1887 -----	2,682,143	819,271	-----	1,266,245
1888 -----	3,153,654	824,762	-----	1,809,451
1889 -----	3,571,024	782,706	-----	1,597,632
1890 -----	4,653,779	122,810	-----	1,391,081
1891 -----	5,854,752	918,233	\$613,845	1,789,910
1892 -----	5,000,632	917,564	551,629	1,970,634
1893 -----	5,361,187	853,509	493,910	2,133,084

Here are \$25,000,000 expended annually by the United States for imported fruit, the larger part of which should be supplied by California. How to reach the consumers of this fruit and control the market for our own State, is the great problem before us for solution at the present time. This subject has been exhaustively treated by a committee of the State Horticultural Society, whose report to the State Fruit Growers' Convention at Los Angeles appears elsewhere in this report. This shows that there is yet a very large, undeveloped market, which must be reached by our shippers.

In addition to this undeveloped market there is a very large number of people to whom California fruit is as yet an unapproachable luxury, but within whose reach it will be placed by more rapid and cheaper means of transportation, for both of which we may reasonably hope.

The area planted to new orchards in the season of 1893 was fully up to the average. In Southern California the plant of orange trees was less than usual, the low prices received for last year's crop and the very large area in oranges having inspired a feeling of doubt as to the future possibilities in orange growing. A stronger feeling prevailed in favor of lemons, although the severe freeze of the preceding season resulted in cautious planting, and only in those localities in which there was a reasonable assurance of freedom from frost, was the planting very extensive. In such localities, however, very large tracts have been set to lemons, and this branch of the citrus industry gives promise of becoming a very important one. Much interest has been awakened in it by the successful experiments of Mr. Garcelon and other intelligent and successful growers, the result of whose experiences have been published by this Board.

Whatever diminution there was in the planting of citrus fruit trees, was compensated for in the setting out of deciduous fruit orchards, and

the large returns yielded from apricots, peaches, and prunes in 1892 resulted in a boom for those fruits, and very large tracts were set to these in the seven southern counties.

In the counties of the San Joaquin Valley also very extensive plantings of deciduous trees have been made. This is especially true of Tulare and Kings Counties, where an impetus has been given to orchard work of late years by the extraordinary yield, large size, and excellent quality of their deciduous fruits. The comparative freedom of this section from fruit pests and diseases has also greatly encouraged the extension of orchard work.

In the foothill regions of Tulare County, very extensive plantings of citrus fruits have been made, the lemon being largely in favor. This has been brought about by the success which has attended orange and lemon culture at Porterville and elsewhere in the foothills of Tulare County.

Extensive plantings of fruit, both citrus and deciduous, have also been made in Merced County on lands reclaimed by the Crocker-Huffman canal; in Placer County; in Butte County, at Thermalito and Palermo; and in different parts of Tehama County. Besides these there have been large numbers of small orchards set out in all the counties of the State, adding very largely to the orchard area.

For the present season the outlook is not encouraging for much in the line of orchard planting. The causes which have combined to depress the prices of fruit and lessen the demand during the past season, have also had their effect upon prospective plantings, and but few large tracts will be set out this season, and these largely to deciduous fruits.

Very much attention is now being directed to the olive; and the culture of this fruit, and its manufacture into oil and pickles, gives promise of becoming one of the most important industries of our State. This work has been very largely aided by the efforts of this Board and the organization of the olive growers of the State. Numerous inquiries have reached me during the year in regard to the best varieties for planting, conditions required for growth, methods of treatment in the manufacture of oil and pickles, etc., all indicating a great and growing interest being taken in olive culture. Some very large tracts have been planted to this fruit in various parts of the State, and large numbers of small orchards have been set out. California may reasonably hope to supply the demand for olive oil in the United States in a few years, and the strict enforcement of the Act for the prevention of its adulteration will greatly assist in this, as it will give a guarantee to the purchaser that olive oil with a California grower's label is genuine.

Not so much attention has been given to figs. Apparent insuperable difficulties stand in the way of success with this fruit. The black fig, which thrives well, is not marketable, on the account of its color; while the Smyrna has not yet proved successful. The white Adriatic is liable to split and sour before it ripens, and so become unfit for use. For these reasons few people have cared about entering into fig production on a commercial scale, and while some remarkably fine fruit has been packed by some growers, fig culture may still be considered as in the experimental stage, awaiting the discovery that shall overcome the obstacles which at present prevent its success, when we may hope to count this fruit among our many important orchard industries.

While there have been a great many new plantings of prunes in the

past season, a feeling of doubt as to their future has taken hold, and there has not been so large a proportionate area of new land set to prunes this year as in previous seasons. Whether this fear is justified only the future can prove, and this may be determined by showing what sections are especially adapted to the growth of this fruit and what are not, resulting in the destruction of many orchards which have been planted indiscriminately, under the impression that the prune would do well anywhere. California is not alone in her extensive planting of prunes; the whole Pacific Coast is experimenting with them—Oregon, Idaho, and Arizona have all made extensive plantings in the past few years—and if the whole area now planted to prunes proves productive, certainly the output will be so largely increased that a wider market than we now possess will have to be found.

The past year has been productive of great harmony on the part of our fruit growers, resulting in their organization into associations for the purpose of regulating the marketing of their products. The benefits derived from coöperative action have been apparent in the work of the older organizations—the California Fruit Union, the Orange Growers' Union, the Santa Clara Fruit Exchange, and other local organizations—and the action of these bodies has made evident the necessity for an association having a wider scope, and the California Fruit Exchange has been the result. The outcome of this coöperative movement will, without doubt, ultimately be a general organization of the fruit growers of our State for the purpose of extending our markets, guaranteeing our products, and obtaining the best prices possible for our crops, while furnishing them to the consumer at fair rates. The advantages of these organizations are evident. No individual can wield the same influence that an organization can, and the larger that organization the wider its influence. If the fruit growers of our State can be made to work in harmony for their own interests, the great questions of markets and transportation will soon be settled, and all fear of overproduction in any line will vanish.

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### III.

#### THE APRICOT.

(*Armeniaca vulgaris*.)

The apricot is a native of Armenia, Arabia, and the highest regions of Central Asia. It is one of the earliest fruits to blossom, and is generally in full flower in February and early March. Success in its culture is by no means certain, for the reason that all varieties do well only in sections adapted to their particular habits of growth and time of flowering. Many varieties that do well along the coast are failures in the interior valleys, and vice versa.

In appearance the apricot is perhaps the handsomest of all stone fruits, and contains less acid. For canning, evaporating, and drying purposes, as well as for use in the fresh state, the fruit can hardly be excelled, and in sections adapted to its culture it is a source of great profit.

The apricot is essentially California's fruit, for here it attains perfection as it does nowhere else in the Union, and we have almost a monop-



oly in its production. In nearly all other kinds of fruit we have to compete with other sections, but not so with this fruit. Our soil, climate, and conditions are peculiarly adapted to the apricot, which is a favorite fruit over a large part of the State, and will thrive in most sections outside of the higher elevations. Its favorite habitat, however, seems to be where the sea breeze reaches it, yet where there is sufficient warmth to encourage its strongest growth. It is a rapid grower and an early bearer, and in the more favored sections has proved itself very profitable.

While a general favorite in many sections of our State, the apricot is worthy of all the confidence it has won, and deserves a front place among the orchard fruits of California. The tree being an early bloomer, late frosts are therefore liable to destroy the orchardist's chances for profits. Locations subject to late frosts should be avoided, as should also low swales, into which the cold air will settle to the detriment of the trees. Situations exposed to the action of the sea breeze are claimed as the most favorable to apricot culture, and the fact that this tree always bends toward the wind, and makes the most vigorous growth on the seaward side, is pointed out as a proof of the correctness of this claim.

#### PROPAGATION.

The methods of propagating the apricot are simple, and are effected by seeds, budding, and grafting. Apricot stocks are more brittle than peach, are not as hardy, and also are susceptible to sourness at the root, owing to excessive moisture. For these reasons, the peach stock is better adapted to work the apricot on. Almond stocks are also used, but are not as desirable as the peach. In heavy soils plum roots are used.

*Planting Peach Pits.*—Peach pits are perhaps the easiest to germinate, and almost any person can make a success of raising seedlings. The best seed, or pits, are from seedling trees, or, as they are termed, "natural fruit;" they are not subject to splitting at the pit, as those from most budded varieties are, and nearly all germinate, and the plants become the most thrifty stocks. The longevity of the tree is dependent, in a great measure, upon the healthy condition of the seed. The union of the two halves of the pits of seedling fruit is very close and tenacious, while in pits of budded fruit is often slight and imperfect. The kernels in pits from natural fruit are generally quite hard, close, and nutty, while in those of budded fruit are often defective, and the two halves frequently separate in handling. The pits should not be allowed to dry after being taken from the fruit; they should immediately be put in sand or layered in the ground, to prevent the germ from drying. There are several methods in use for layering the seed. The most common one is to layer the pits in a well prepared seed-bed in the fall. The place selected should be in soil free from standing water during winter. As the seed is to remain until spring, an excess of moisture will destroy their germinating power. Seed-beds are made from 4 to 8 feet wide, and as long as necessary. The earth is spaded away for a depth of 6 to 8 inches, and the pits spread about 4 to 6 inches thick, and then the earth is spread on top, covering them for 4 to 6 inches. They are allowed to remain there until early spring.

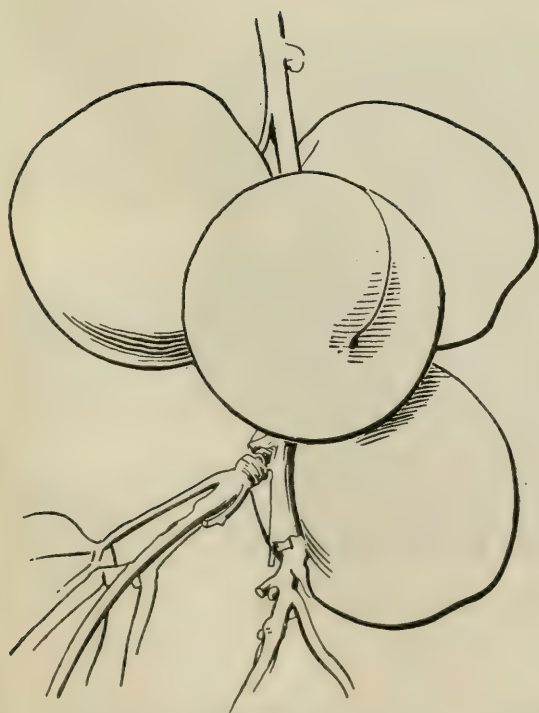
Another method is by spreading the seed thickly about 4 to 6 inches deep, and then spading in about 6 inches deep. This completely mixes the seed, and it is covered in the soil. In either method the seed must

THE APRICOT.

PLATE VI.



1. Pringle.



2. Newcastle.



3. Pit of Newcastle.

remain in the ground until spring, when the shells are so far loosened that in handling they separate from the kernel. The kernels are at that time swollen and many will be found sprouted. They are then ready to be planted in nursery, and care is required in their handling so as not to break the tender roots of those sprouted. The planting of the seed in permanent nursery rows in the fall is also practiced, but is not recommended, as the seed does not come up evenly and prevents the ground from being worked after rains, etc.

The young trees having grown to a suitable size are budded in the summer.

#### LOCATION FOR APRICOTS.

By George M. Gray, of Chico.

After the rainy winter of four years ago quite a large number of trees died in this part of the State, and again this spring after the continued rain of last winter a great many trees died and many more are not doing well; they are losing here and there a limb, gum is working out of the bark, and they split down much more easily than they did before. I am convinced that one must be very particular in selecting a location for an apricot orchard, a good deal more so than for peaches, pears, or cherries. There should be good drainage, a deep soil, no ditches above that might seep through and reach the roots of the tree, and "last but not least," where there is never more than twenty inches of rainfall in any one winter, and frost does not cut the blossoms.

#### SOILS FOR THE APRICOT.

A moderately light, sandy loam, well underdrained, is perhaps the best for the apricot. At Campbell's, in Santa Clara County, where this fruit is very extensively grown, the trees do well in a deep gravelly loam, the wash of Los Gatos Creek, in which there is no water within 30 to 40 feet of the surface. Near San José Mr. Holmes has a remarkably fine orchard. This yields large returns, sure crops, and excellent fruit. The soil is well underdrained, however. While the apricot may do well in such soil, its favorite is a lighter loam, and the superior ease of working such is an extra inducement in the selection of lighter soils for the apricot orchard.

By Judge W. C. Blackwood, of Haywards.

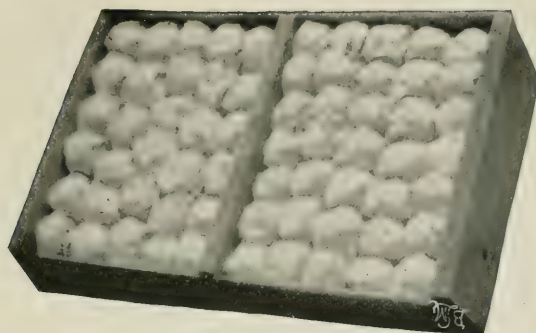
A moderately moist loam is the best for the growth of the apricot. Too much moisture is ruinous. A clay soil is not good. The tree seems to thrive best where it has a moderate exposure to the ocean breezes and genial warmth of temperature; hence, the wonderful success which has attended its culture around the bay of San Francisco and coast counties farther south. Its cultivation has never been successful in the Atlantic States, and it does not succeed very well in many of the interior counties of our own State. The climate of the interior seems to be too dry and hot, and if artificial irrigation is resorted to there the gum disease develops, and the fruit when ripe is watery and deficient in richness.

The general rules laid down for the preparation of the land for the orchard apply especially to the apricot, and the soil should be thoroughly prepared by deep plowing, cross plowing, and sub-soiling, and where possible should be left exposed to atmospheric action for some months before the trees are planted. It is a safe rule that land intended for orchard cannot be worked too much or too thoroughly.

#### PLANTING.

The best time for planting the apricot is in January and February. The tree at this time is entirely dormant, and the best results are obtained. The young trees should be carefully removed from the nur-





BOX OF APRICOTS.

The above illustration shows a box of apricots properly packed for shipment, each fruit being wrapped in paper.



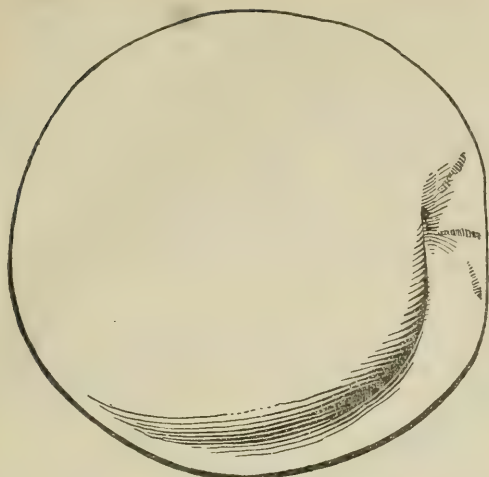
BASKET OF PEACH APRICOTS.

The above illustration shows a basket of apricots properly packed for shipment. In this method a layer of paper is placed between each layer of fruit, and the baskets are arranged in crates.



THE APRICOT.

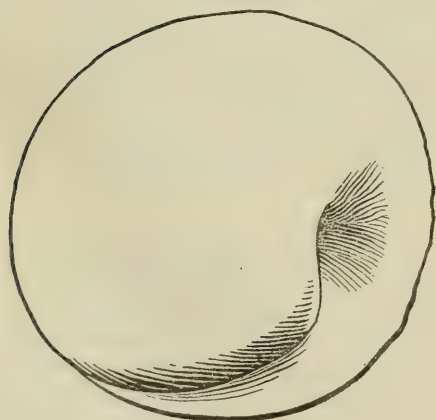
PLATE VII.



1. Moorpark.



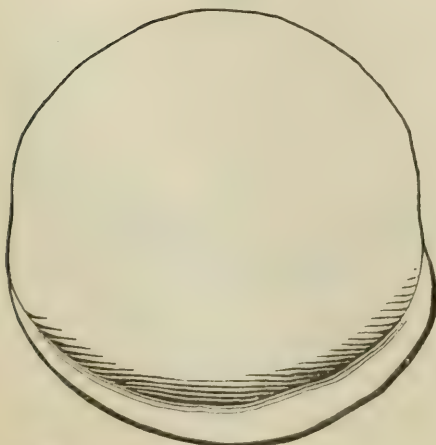
2. Pit of Moorpark.



3. Royal.



4. Pit of Royal.



5. Blenheim.



6. Pit of Blenheim.



sery row, care being taken to preserve as many roots as possible. Those bruised or broken should be cut off with a sharp knife, making a clean cut. Holes of ample size should be prepared for their reception, and the bottom soil should be thoroughly pulverized. The trees should be planted at the same depth and same exposure in which they stood in the nursery row. The roots should be spread out, and the soil carefully filled in around them and well packed down. When in position the top should be removed, and a stem of 6 to 12 inches left for the future tree. The apricot is a vigorous grower, and makes a very large top. It therefore requires an abundance of room. The trees should be set at not less than 24 feet apart, and many growers recommend 30 and 35 feet as preferable.

In planting, trees one year from the bud are preferable to those of greater age, although many growers advocate the planting of dormant buds, claiming that these in a few years will surpass in growth the one-year-olds from the nursery, but require considerable attention the first year.

#### PRUNING.

In pruning the apricot, skill and judgment should be exercised. It should be borne in mind that we are forming a tree that is to last for a generation, and perhaps several, and that the greater part of this work is to be done in the first three years of its orchard life; that these three years' care will decide whether the tree shall be a success or a failure, whether it shall be a source of pleasure and profit to its owner, or a source of anxiety and care. The tendency of the tree is to overgrow; it runs largely to top, and the winds break the limbs and ruin the symmetry of the tree.

The objects to be attained in pruning are strength of limbs to bear their load of fruit, sufficient new wood to insure abundant fruit without overcrowding, and excellence of fruit. To accomplish this the young limbs should be so trained as to give them the greatest bearing power, and to this end the tree should be headed low and the branches given an oblique upward direction. The limbs should be at different heights on the trunk and evenly balanced on all sides. Avoid forks, which are liable to split when the tree is large. Such pruning makes a symmetrical tree and distributes its load equally on the trunk.

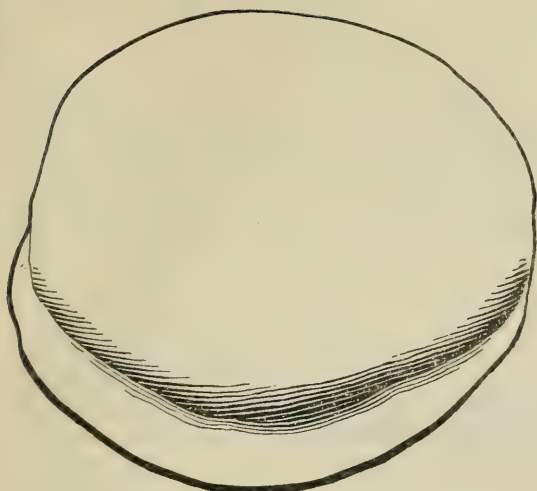
The object of the first year's work in pruning is more to secure a solid, stocky tree, capable of carrying its future load of fruit, than with any view of immediate profit. If the work is properly done, a thrifty tree will result, and the patience and care of the orchardist will be well remunerated. When the tree has been formed, the question of pruning becomes one largely of locality and variety. In some places, with some varieties, the tendency is to make wood too rapidly. In others the growth is slower, and the tree is able to support all its wood and fruit, and little, if any, cutting back is required.

The matter of pruning, not alone of the apricot, but of other deciduous trees, is a mooted one, and has given rise to more argument than any other phase of orchard work. It is here that the judgment of the grower must be exercised, and he must consider the character of his soil and climate, the varieties he is growing, and the peculiarities of each individual tree.

The tree from the ground should be trained to form a low, well-bal-

THE APRICOT.

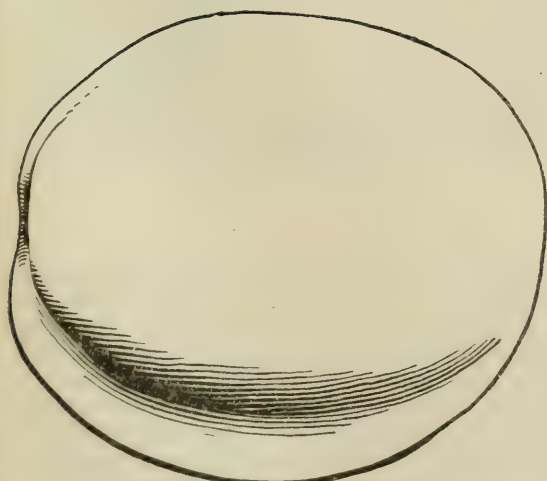
PLATE VIII.



1. Peach.



2. Pit of Peach.



3. Montgamet.



4. Pit of Montgamet.

anced head. Train to a central stem and leave the lateral branches, three to five in number. The second season's pruning consists in heading back the vigorous growth of the first year to twelve or fourteen inches, while all branches springing from the underside of the main limbs and all which cross each other are removed.

By J. B. Parker, of Orange.

The apricot with us grows much as it does in the north. From my experience and from what I have read and heard, I find that the tree has a tendency to branch out too much, and I give it a summer pruning about the last of May, as a rule. I give it a fall pruning also, and cut back within ten inches of the old growth; that is, on the last ten inches of the new growth on each tree. The result is that I get my trees in a very compact head and my trees blossom finely. Some did well where they were pruned once a year, but my observation goes to show that the summer pruning had a great tendency to make the fruit earlier, though it might have the effect to dwarf the tree in the future.

By Dr. Edwin Kimball, of Haywards.

In regard to pruning the apricot tree, the old saying will properly apply: "He who spares the rod spoils the child." It is necessary to use the knife freely on the apricot tree, in getting it into proper shape. It is a tree which is particularly inclined to overbear, the consequence of which is a large quantity of small, inferior fruit that you cannot sell to canners at all, and which takes a longer time to prepare for drying. In raising apricot trees, if you receive the trees from the nursery, yearlings or two-year-olds, I think that they should be trimmed severely for about three years, to place them in a condition so that they will not split down, for I believe that of all the trees that we rear in the central part of the State, and perhaps here, the apricot is more inclined to split down and be broken by the wind and by its weight of fruit, than any other tree that we raise. I have had some trees that I think produce from 700 to 1,100 pounds of apricots in a year, and they are not headed at all; or, I might say, headed in a group—two or three limbs divided right together. In first forming a tree, if you let three buds come out together and reach out in different ways, when the trees bear heavily, they will split down. The tree should be shaped, if possible, so as to have one leader—one center—and they should be trimmed to come out, not at a point of junction, but two or three or four inches above or below, and you have a symmetrical tree, and without danger of breaking down in that way. As I have said before, it is necessary, in order to get the best results, to thin out thoroughly. I always leave these lateral branches from the central branch that forms the head of the tree—one coming out on the east, one on the west, one on the north, and one on the south; trim them similarly as you do the center and you have then a symmetrical tree. Of course, the apricot tree should be severely cut, because if you let the tree fruit and if you trim it too close—hedge-like form—you will have a large quantity of fruit of an inferior quality; but if you cut back to the three lateral branches besides the main center, keep it thoroughly thinned out, and when you cut off the ends of the limbs of a year's growth do not let it be too broomy; by that way you save the process of going through your trees and thinning them so much, for in our section of the country we not only have to trim our trees sharply, but go through and pull off the fruit.

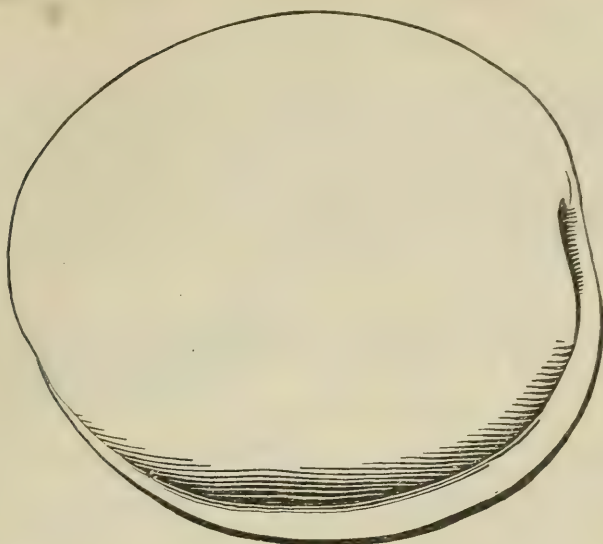
In regard to summer pruning, if there is danger of the tree growing so fast as to become very much out of shape, as apricots sometimes do, I would use the knife to put it in shape. The apricot is the most wonderful grower, I think, of any tree we have. If I find its limbs commence growing down instead of growing up, I cut those off, but we do most of our pruning in winter.

#### THINNING.

Thinning the fruit on the trees is as important as pruning, and requires as much care. It is not a pleasant thing for the young orchardist to pick off and throw away one half to two thirds of the fruit which he has been so anxiously working and waiting for. Yet the operation will pay him in the superior size and quality of the fruit which is left to mature and in the extra price it will bring. Apricots which are smaller than twelve to the pound are not desirable, and a tree three inches in diameter should yield fifty pounds of fruit; this would leave six hundred apricots to the tree. As the tree increases in age and diameter, its weight of fruit may be increased.

In the matter of thinning the fruit, as in other points of orchard work, authorities differ. All admit that some thinning is necessary in order

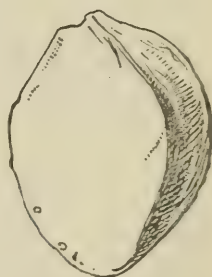




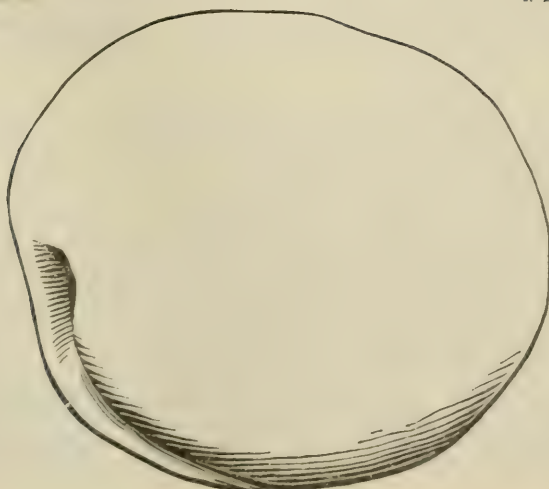
1. Sparks.



2. Pit of Sparks.



4. Pit of Routier.



3. Routier.

to achieve the best results, but the amount of thinning to be done is the matter in dispute.

By D. C. Vestal, of San José.

Don't thin much. Where there are large clusters and the fruit is crowded, remove the smaller specimens and leave the larger ones room to develop; but where there is ample room for your fruit to grow without crowding, leave it alone. Of course, I recognize the fact that the apricot is liable to overbear and produce a large crop of small and worthless fruit if left alone, and to overcome this I prune my trees when they are in bloom, removing enough of the blossom-bearing wood to relieve the tree, and leave the strength of the tree to be forced into the young fruit. I think this is preferable and produces better results than where the tree is left to half mature its full crop, only to have its efforts wasted by the throwing away of a large part of the half-grown fruit. Whether I am right or wrong, it is my way, and I have no cause to change my opinion in the output of my trees.

In the matter of both pruning and thinning Mr. Vestal differs widely from many other growers of prominence. Among them J. H. Flickinger, who advocates and practices both severe pruning and vigorous thinning.

By J. H. Flickinger, of San José.

Thin, and thin vigorously. Of course a great deal of judgment must be used here as elsewhere in orchard work. We have to take account of the seasons, the bearing qualities of the tree, the quantity of fruit which has set upon it, and the variety of tree. Some apricots, as the Blenheim and Hemskirke, will mature more fruit than others, and require a more vigorous thinning in order to secure the best results. But taking the average apricot tree, in a condition to carry through and mature its entire load of fruit, and when fruit sets thick on it 75 per cent should be removed. In unfavorable seasons, when the crop does not set so heavily, lighter thinning must be had, or, in some instances, none at all. The grower must calculate how much his tree ought to carry, and how many apricots will make a sufficient load for it; how many it can bring to the highest state of perfection, and then, without any hesitation, remove all the rest. It is better that a man should harvest two hundred pounds of good fruit, for which he can command a high price, from a tree, than that he should gather five hundred pounds of inferior stuff, which he cannot sell at any price. By the process of thinning the greater part of the weight is left, the tree is relieved of a large part of its burden, and can carry the remainder with less danger of breaking down under it, and the fruit will command a much higher price.

The larger number of growers believe in thinning very extensively. The work is commenced immediately after the fruit has stopped dropping, and when it is known to what extent the dropping will render thinning necessary. The trees sometimes thin themselves and render further attention in this direction unnecessary, but when it is necessary to lighten the load they must be thoroughly thinned by hand, and after a careful estimation of the quantity each limb will bear, the rest should be removed.

By E. A. Bonine, of Lamanda Park.

We invariably go over our orchard, whether the crop is light or heavy, and thin our fruit; thinning by hand, the only proper way. I know people who throw stones up, and others who use pitchforks and thrash the trees. I have been told, "Oh, I never thin; the big ones will crowd the little ones off."

The past two springs our apricot trees were an unusually long time blooming, caused by an insufficiency of rain during the winter season; no irrigation is practiced. I thought that the small fruit coming so much later than the bulk of the crop would be so much later in ripening, but they all ripened together, and last season the trees were heavily loaded; this season very lightly; so I concluded that the trees having plenty of sap the little ones would ripen later and grow large; but again they all ripened together. We had a plentiful supply of rain last winter, but it could not affect the already formed and partially dried-up fruit spurs. Next year *I shall pick all the little ones off*, no matter where located. While the men are thinning I examine their work. The first thing I do is to look upon the ground, and if the small ones are there, so far so good; then I look over the tree and see if they have scattered them properly. An upright limb at an angle of 45° will hold more fruit than a horizontal one or one bending or hanging down, for the reason that when the limb bends the flow of sap is retarded; the reverse principle acts exactly the reverse. Should a shade or ornamental tree lose its top by wind or accident, a leader can be made quickly by bending a branch upright and tying it there,

THE APRICOT.

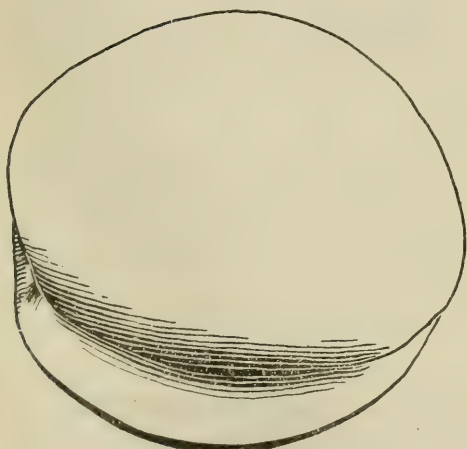
PLATE X.



1. St. Ambroise.



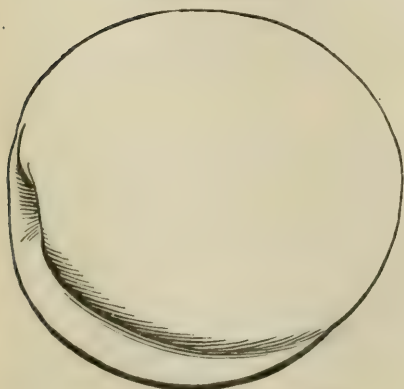
2. Pit of St. Ambroise.



3. Hemskirke.



4. Pit of Hemskirke.



5. Large Early.



6. Pit of Large Early.



so that it can receive a strong flow of sap. I have seen seasons when all the fruit grew upon one fourth of the tree, and that would be heavily loaded. Only a certain amount of sap can flow through a limb, and the thinning must be done as resolutely on the small crop, if not spread over the tree. The man who goes into the fruit business without any love for investigating nature's ways, who plants trees and expects to do no other work than when the fruit is ripe to go and pick it, will surely get left, for trees require care, and they must have it at certain times, and I incline to the opinion that very large orchards will seldom be profitable.

As to how far apart the fruit should be upon the tree, you can establish no rule, for fruit does not grow regularly over the tree and you must be governed by the vigor of the tree. At thinning time the tree that is overloaded has generally a deficiency of leaves, and the size of the fruit at that time decides how much to take off. I generally send the men back to such a tree and tell them how much more to take off, for they seldom remove enough. Be sure of one thing: thinning fruit is not like the new fruit-cutting machines as advertised, that profess to cut three tons an hour and a child of twelve years can run them. A neighbor sent out a small boy to thin his cling peaches; after he had been out a time, he went out to see how thoroughly the boy had done his work. He had finished six trees and had picked *all the peaches off*.

I consider the proper way to do is to *avoid thinning* as much as possible. In pruning, go over the sides and tops of the trees with a pair of handled shears; we use light ones—two feet three inches long. The pruner uses a step-ladder for top work, and cuts the branches eight or ten inches from the last pruning, and generally throws his prunings off with the shears; then takes a very light pair of hand shears and goes through the center and trims short all the new growth. If you prune in this way you will not need to thin so much. If fruit trees can be prevented from over-bearing they will bear more regularly. This great quantity of fruit that is picked off is a great waste of life force; but we must thin anyway; all small and defective fruit must come off before the stone hardens, and we find it wisest considerably before.

Some one advised thinning the blooms, but he is too smart for anything. Perhaps he sits by his desk and does his thinning, or maybe he has half a dozen trees in his back yard and writes "all any one needs know about fruit raising." His heart would certainly fail him if he looked upon a fifty or one hundred-acre orchard in full bloom.

#### PICKING.

Picking the apricot is usually done by hand, and is a simple operation. Whether the fruit is intended for drying or for canning, it is left on the tree until thoroughly ripe and is then gathered by hand, step-ladders being used to reach the higher limbs. Each fruit as it is picked is carefully placed in a box. The boxes are placed on a truck and taken direct to the cannery or drier.

The fruit intended for shipping is picked with care before it is thoroughly ripe.

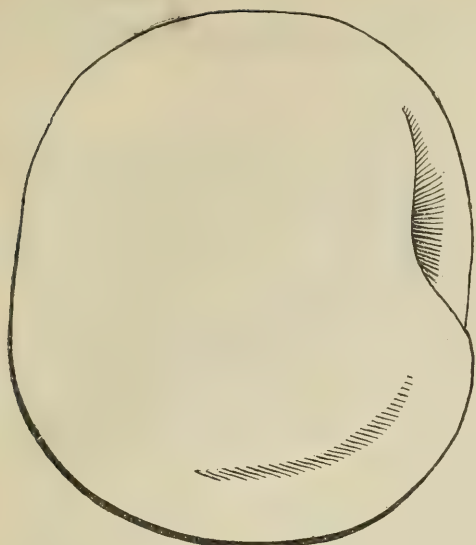
By Arthur J. Towner, of Santa Ana.

When picking time comes I have the ground in my orchard under the trees as smooth and free from clods as I conveniently can. Then, as the fruit ripens, I have that on the lower limbs picked by hand, while that on the higher limbs is generally jarred off. For this the pickers use a long forked stick, shaking one limb at a time. The fallen fruit is quickly and carefully picked up and taken to the cutters as soon as possible. For this I use a stone-boat and steady old farm horse. Very cheap help can be used for picking up the fruit in the orchard—cheaper than that paid a regular "picker."

No fruit need go to waste by this process, unless it be the very little green which may jar off, and of this not so much as is *rubbed* off when the pickers climb about in the trees.

Toward evening, however, there must be fruit left over night for the cutters to begin on in the early morning. This fruit I have picked by hand, as it will keep better. We have generally paid cutters—they "lay" and cut both, of course—15 cents per 75-pound box. This is more than some pay, but I have better help at this price.

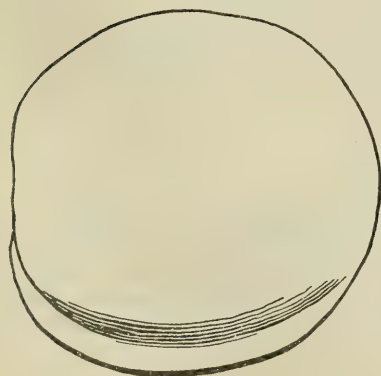
I would here emphasize one special economy the fruit farmer must practice who would make the most off his apricots: *Save all the dropped fruit*. I do not mean the fruit jarred off, but that which falls of itself. This in any apricot orchard, however carefully picked, is inevitably a large percentage. According to my observation, this is generally left to rot and waste. According to years of experience this fruit, if saved, over and above paying for itself, will pay much toward all the running expenses of a season's cure. Year after year I calculate it has paid for my trays, my boxes, etc. Some heavy years I know this fallen fruit, saved, has amounted to enough to pay for all my hired help. It is a slow, insidious waste, and as I said before, quite generally passes unnoticed; yet it makes fine dried fruit. In the height of the season the whole orchard must be gone over twice a day to gather up the dropped fruit. I have used very cheap help for this. Children can make good wages at it. I do not allow this fruit to be piled in the



1. Vestal No. 2.



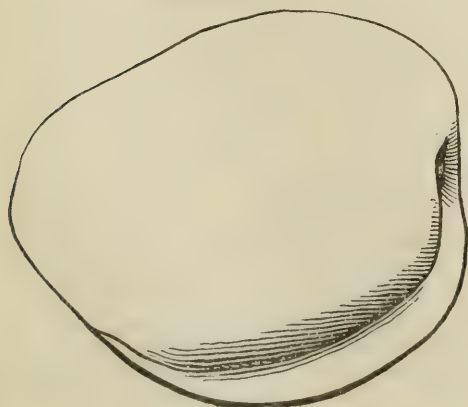
2. Pit of Vestal No. 2.



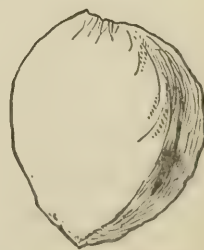
3. Jackson.



4. Pit of Jackson.



5. Smith's Triumph.



6. Pit of Smith's Triumph.

boxes—only half boxes of it, to save crushing it—better still, if it can be cut from the baskets.

In fruit raising, as in any other business, the most money is made by utilizing everything. Even the green apricot, where there is a market for it, can be made into jelly and sold.

#### GRADING.

After the fruit is gathered, and before it is delivered to the packer, it is run through a grader and assorted into from two to more sizes. This work is done very rapidly by means of improved machines, of which there are several on the market—some with meshes of different sizes to allow the various sized fruit to pass through into the receptacles placed to catch it below; others substitute sheets of galvanized iron, perforated with round holes of the required sizes to permit the passage of the fruit, and others are arranged with one or two revolving rollers, which can be adjusted to any size to suit the kinds of fruit upon which they are to be used. Most graders are made in the form of an inclined plane; some, however, vary from this and are constructed in the style of a fanning mill, with the different sized screens arranged one above the other, with a slight incline, and arranged with a spout on the side, where each size drops into a box arranged to receive it.

The objects to be attained in grading the fruit are equality in drying and the more uniform appearance of the cured fruit. The smaller fruit dries more rapidly than the larger, and by grading into sizes as it comes from the tree greater uniformity in drying is secured and a more even quality of finished fruit is the result. The grader also removes all twigs, leaves, or other foreign substances which may have become mixed with the fruit in picking.

#### CUTTING FOR DRYING.

In the cutting-house large benches are arranged, around which the cutters, usually women, girls, and boys, sit at their work. Each one of these is furnished with a tag, upon which the foreman makes a punch mark for each box of fruit cut. These tags are turned in after the day's work, and each cutter is credited with the amount of work recorded thereon.

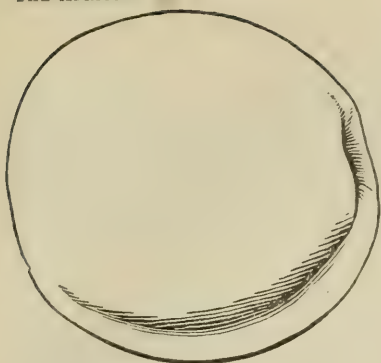
In cutting apricots a small knife is the favorite implement. Cutting and pitting machines are used to a very small extent, but little economy being found in their use, while the fruit which is fully ripe is liable to injury from bruising. The fruit is given a rolling motion with one hand as the knife is pressed and drawn upon it with the other, and the operation is a very rapid one. An expert cutter will halve and pit half a ton of fruit per day. A very simple but effective improvement on the ordinary knife, is the Mosher fruit knife. This is a stationary knife, so arranged as to leave the operator both hands for use. In this the fruit is held with both hands, between the thumb and index finger, and forced against the blade, or cutting portion. A quick pushing and turning motion is given, and the fruit is separated, with a clean cut, into two halves, while the same motion removes the pit by a slight pressure of the half retaining it against the lower portion of the blade.

On the work benches around which the cutters are engaged are placed the drying trays, and as the fruit is halved it is placed on these, cut side up. A number of operators usually work on the same tray, which is



THE APRICOT.

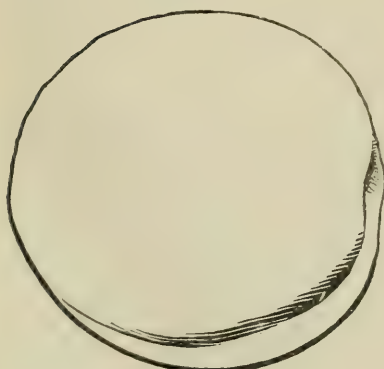
PLATE XII.



1. Duboise's Early Golden.



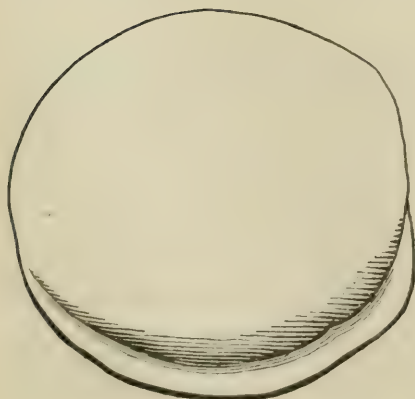
2. Pit of Duboise's Early Golden



3. Roman.



4. Pit of Roman.



5. Beamer.



6. Pit of Beamer.

thus rapidly filled, and as soon as filled is removed and placed on a truck ready for the sulphur-house.

#### DRYING TRAYS.

The trays are simply shallow wooden receptacles, of various sizes, according to the judgment of the owner, made of light wood, and easily handled. They are generally made of half-inch material, the usual size being three feet long by two in width, fastened at each end by a cleat. This size of tray has been found the most convenient to handle, requiring but one person to move it. In raisin districts the same trays are used for curing raisins later in the season.

By F. M. Richter, of Campbells.

Profit by the experience of others, and make no tray less than 3x8 feet. It costs as much to handle a 3x6-foot tray as a 3x8-foot tray, while about one third more fruit can be handled by using the larger tray; thus using a 3x6-foot tray results in a great and unnecessary loss.

So near as I can learn, the preference is decidedly and wisely in favor of Oregon pine for sides, ends, and lath, and 6-inch sawed redwood shakes. The objections to white fir, termed "white wood" by some, are that "it warps badly," and is "short-lived." *Split* redwood shakes also have the fault of warping more than *sawed* redwood. With the exception of the lath, first-class redwood makes a very good tray—perhaps as good as any. The tray frame should be 1x3 inches. The redwood shakes should be seasoned before using for the tray, or the fruit may be stained where it comes in contact with them.

Make a rough table 5x9 feet, as high as convenience in nailing may require. On this construct a tray-holding frame in this manner: Fasten firmly to the table's top two side-pieces, 2x3 inches and 7 feet 10 inches long. The inner sides of these pieces should be parallel with the side edges of the table, and respectively 11 $\frac{1}{4}$  inches from those edges, their ends being respectively 7 inches from the ends of the table. The distance between these pieces is 36 $\frac{1}{4}$  inches. Place two 3-foot end-pieces 2x3 inches, the inner sides of each being respectively 5 $\frac{1}{2}$  inches from and parallel with the ends of the table, and the ends of the end-pieces on a line with the inner sides of the side-pieces and 1 $\frac{1}{2}$  inches from the ends of those pieces. This completes the outer portion of the tray-holding frame, the dimensions of which are 36 $\frac{1}{4}$  inches by 8 feet  $\frac{1}{4}$  inch, being  $\frac{1}{4}$  inch larger on both the sides and ends than a 3x8-foot tray. Put the tray-frame into this incomplete tray-holding frame and nail it together with eight 2 $\frac{3}{4}$ -inch wire nails. The inner portion of this tray-holding frame may be made of 2x2-inch material. Place the two side-pieces, 7 feet 10 inches long, within  $\frac{1}{8}$  of an inch of the inner sides of the tray-frame, and the end-pieces the same distance from the ends. Make the end-pieces each 15 inches long, leaving 4 inches unoccupied in the middle of the tray-holding frame. Fill this 4-inch space through the center of the tray-holding frame with a piece of timber 2 $\frac{1}{2}$  inches thick, 4 inches wide, and 7 feet 9 $\frac{3}{4}$  inches long, covering its entire upper surface with a strip of sheet-iron  $\frac{1}{8}$  of an inch thick. The tray-holding frame is then complete. The space to be occupied by the tray-frame is 1 $\frac{1}{4}$  inches wide. It is well to have it that width, as some of the sides and ends of the trays are more than an inch thick; besides, if the space were less the work of putting them in and taking them out could not be done so quickly.

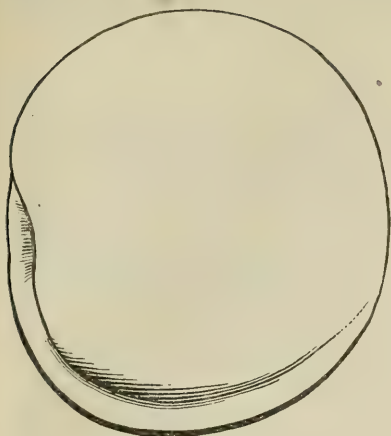
Make a mark in the center of the outside ends of the tray-holding frame; this will show just where to place the central lath, and thus prevent loss of time that would otherwise occur. The unoccupied space along the sides and ends of the table is intended for holding nails. Partition this space into four apartments, each the full length of the tray-holding frame, to be occupied by nails of as many lengths. The ends will each need one space for nails, which should be as near the ends of the central lath as possible, as it is to contain the nails used in the ends of that lath. Use  $\frac{3}{8}$ -inch clout nails in the central lath, except the end of it; use wire nails there and at all other places. I think 2 $\frac{3}{4}$ -inch nails for the tray-frame; two sizes, 1 $\frac{1}{2}$  and 2 inches, for shakes and side lath, are large enough. Six nails are required for each 6-inch shake—two at each end, two in the middle.

After the tray-frame has been nailed together with 2 $\frac{3}{4}$ -inch nails, put on the sixteen shakes required to cover the bottom. Fasten these in their places by putting one 1 $\frac{1}{2}$ -inch nail at each end of every shake, an inch or so from the same edge. These nails are large enough, since they are prevented from coming out by the lath being placed over them.

Use 2-inch nails, or a little longer, in putting on the side lath. Drive these nails through the side lath, so as to pass through the shakes about the same distance from the edge as did the 1 $\frac{1}{2}$ -inch nails, and directly opposite them. Next nail the central lath with 1 $\frac{1}{2}$ -inch nails at each end, taking these nails from a receptacle made as near as possible to the place where the nails are to be used.

THE APRICOT.

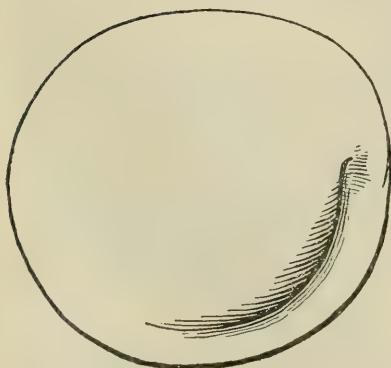
PLATE XIII.



1. Coulange.



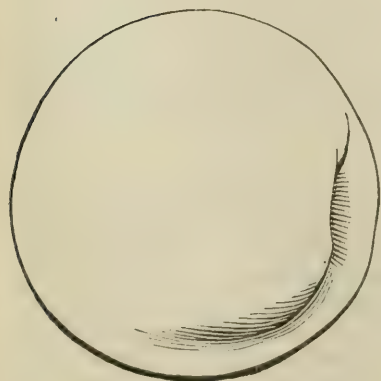
2. Pit of Coulange.



3. Triumph de Busseire.



4. Pit of Triumph de Busseire.



5. Glori de Pourtales.



6. Pit of Glori de Pourtales.



All other nails used in the central lath should be  $\frac{3}{4}$ -inch clout nails, driven at a slight or very acute angle. If so driven they will clinch themselves on striking the strip of sheet-iron. That is the object of the sheet-iron. If not so driven the point may stop when it strikes this iron strip and fail to clinch, thus causing a waste of time and nails, besides rendering the sheet-iron strip worse than useless.

By Arthur J. Towner, of Santa Ana.

The ideal tray, to my mind, on which to dry apricots, is 2x3 feet, and made of sawed lath, smooth side up, with inch or  $1\frac{1}{4}$ x $\frac{3}{4}$ -inch stuff for *sides* and half-inch lath for *ends*, and cross-piece underneath. This is an important point to me, simple as it sounds, for I look ahead to save wear and tear. Some use the heavier stuff for ends and the lighter for sides; but this way the sides are apt to spring when weighted and piled high, and hence many will spring in one season's use. Not so the other way, according to my experience, for, you see, with inch sides, springing is not only prevented, but the end-piece, which must be lapped on, can have two nails in it; and in the stay or cross-piece underneath, a larger nail can be used. A mechanical eye can see by this that the parts of the tray are tied together, as it were, and must necessarily be stiffer in handling, and more durable. I generally allow fifty trays per ton of green fruit, calculating it takes from four to five days to dry the fruit. Stretchers for carrying the loaded trays must be strongly made, of size to hold two piles of trays, and any style otherwise to suit your fancy. The number of stretchers is according to size of orchard or crop and methods of handling and sulphuring. As to amount of fruit to be laid on each tray, one must know enough of the matter, by doing it himself, to be able to watch the cutters carefully and that he lays the fruit well, skin side down and pretty well crowded on the trays. And the fruit must be cut evenly in two—a clean cut—leaving no shred of attachment, or the halves will not dry in good shape. Very soft fruit must be deftly shaped a little when laid down. And right here I will say that for the apricot I do not believe in any cutting or pitting machine that ever has or ever will be invented. In order to use a machine the fruit has to be too hard to make first class dried fruit.

#### SULPHURING.

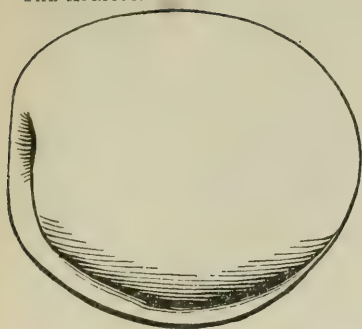
When the trays are filled they are removed by attendants and placed on a truck, which runs on rails between the rows of cutting tables and leading direct to the sulphur-house. Twenty trays or more make a truck load, and these are separated from each other by slats, leaving a space through which the sulphur fumes can penetrate, reaching every part of the fruit. When a load has been made up it is run into the sulphur-house and exposed to the fumes of the burning sulphur for a space varying from a few moments to several hours, according to the ideas and judgment of the operator. This operation sets the color of the fruit and renders it more attractive in the market.

Like many other matters in fruit growing and curing, the sulphuring process has many advocates and enemies. The former claim that fruit is improved by sulphuring, the latter that it is injured. Without going into the merits of the case, it will be sufficient to say here that fruit is sulphured; that its attractiveness is increased by the operation, and that it finds a readier sale than the unsulphured article. These being existing facts, and there being a public demand for light colored fruit, the driers will accede to it, and those whose scruples may prevent them from resorting to the process of beautifying their fruit will sacrifice their profits to their scruples.

The best bleachers are so constructed that a truck load of trays can be run into them and extra handling be avoided. Their usual dimensions are 4 feet in width, 6 feet in length, and 7 feet in height. At each end is a door, usually hinged at the top and made to open up by means of a rope and pulley. An ordinary four-wheeled truck can be used, and on this are piled the trays of cut fruit, thirty or forty in number. The loaded car is run into the bleacher, the sulphur ignited, the doors closed, and the fruit exposed to the sulphur fumes. From this bleacher the fruit is run direct to the drying-ground. In small orchards

THE APRICOT.

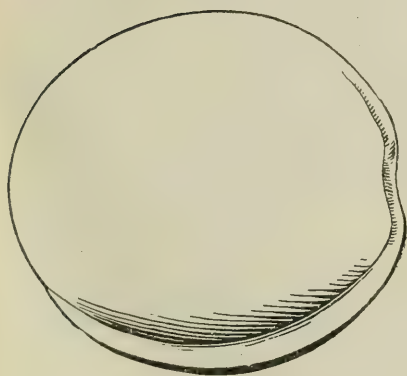
PLATE XIV.



1. Kaisha.



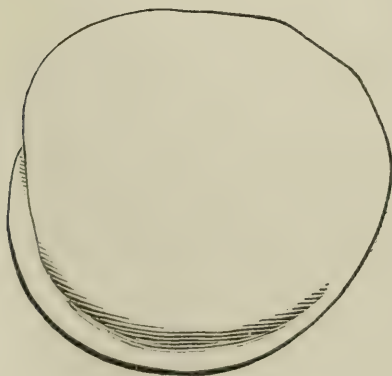
2. Pit of Kaisha.



3. Jaques.



4. Pit of Jaques.



5. Jannicet.

a less elaborate bleacher can be used. This is simply an upright box, made tight, with cleats on each side, into which the trays of cut fruit are slid. The most convenient size for these is a little over 3 feet in width, so that the 3-foot trays will slide on the cleats easily; 4 feet 8 inches long, which will admit two trays and leave a clean space of 8 inches; and of any convenient height, say 6 to 7 feet. These are made on an outside frame, flooring timber being used on the inside, which gives a smooth, tight surface on three sides and the top. There is no floor required, and the whole front opens with a door, hung either from the top or side. Inch square cleats, about  $3\frac{1}{2}$  inches apart and starting 18 inches from the ground, are nailed on the long sides of the bleacher, upon which the trays are placed. This is the whole construction of a bleacher, and one of this size will accommodate thirty to forty trays, according to its height. In placing the fruit in the bleacher, the extra space between the walls and the trays should be divided, leaving the trays one inch from the walls and an inch apart; this permits the sulphur fumes to permeate every part of the bleacher and to reach all the fruit. Some growers, however, place the trays tightly against the wall, leaving the entire space on one and the other side, alternating with each two trays. On the first cleat the two trays would be set right against the back; on the second, brought close to the front; on the third, to the back; and so on till the bleacher is full, when the door is closed tight against one half the trays and the back is tight against the other half. By this plan, when the sulphur is ignited, the fumes are forced back and forth over the entire surface of the fruit to the top of the box.

The process of bleaching is very simple, and after the fruit has been arranged, consists of igniting a small quantity of sulphur, from one to two pounds, either crude or sublimated, in an old iron pan or dish, sunk slightly in the ground on the inside and near one edge of the bleacher. A moderate draft may be allowed, but the fumes of the sulphur must be confined to the bleacher.

By Arthur J. Towner, of Santa Ana.

I use a light, stoutly made, portable sulphur-box—one that I can set down over my trays wherever I pile them. I make a frame and cover it with a certain tough but pliable paper, which I purchase at the paint stores. This, for myself, I make large enough to hold two piles of my 2x3 trays, thirteen in a pile, *i. e.*, twenty-six trays, and leave room at one end for the pan I burn my sulphur in; *i. e.*, 6 feet long, 3 feet high,  $3\frac{1}{2}$  feet wide, inside measure. This is big enough to hold stretcher as well as trays, for it saves one handling to leave the trays on the same stretcher on which they were piled in the cutting-room. (Be sure and cover the sulphur-box at night, to prevent fogs or dew warping the paper.)

As to quantity of sulphur for a box of such a size, I use one coffee-cupful best California sulphur, leaving the fruit in the gas one hour; and as to quantity of sulphur and rules therefor, let me remark in passing, that one must use enough to fill the given space with the sulphurous acid gas; that is, gauge your quantity of sulphur by the cubic contents of your box, not by the number of trays.

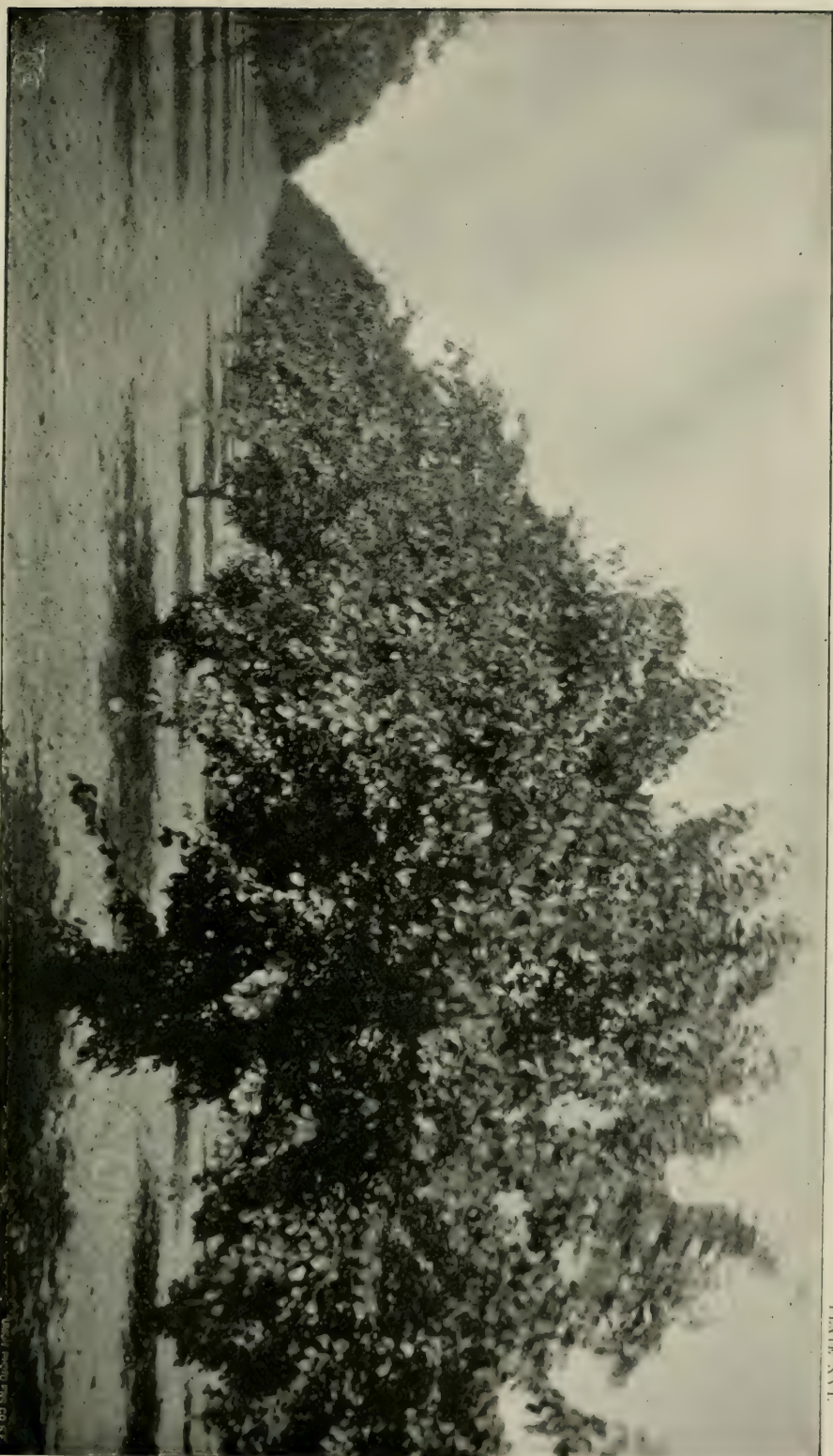
My method of burning sulphur is very simple. I take a newspaper, crumble it very compactly so as to make pockets all over it, lay it in my pan (an oil can split in two); pile my sulphur thereon, crowding it down; set the pan by my piles of trays, and, before I let the box slide over them, set this paper afire. It is simple but efficient. And yet, after all, this is not so simple as it sounds. A "green hand" is apt to arrange the paper and apply the match in such a way as to "fire off" the sulphur too quickly. The paper must be lighted on one side only. And one must vigilantly guard against two things, *viz.*: that the sulphur does not burn too quickly, and that it does not "go out on you," as we say. A long, *drawn-out smudge* is what is wanted; a keeping up of the bleaching process. If this is not effected, not only do you not get your money's worth out of your sulphur, but the under part of the fruit, the *skin*, is not bleached. In this case the fruit will be tougher, longer drying, and the *dark* back will spoil the appearance of the cut surface, no matter how bright it is. The ideal dried apricot is flat, of an even amber hue clear through, bright on the cut surface, and so translucent that when held





Two rows of French Apricot trees (6 years old) in orchard of R. C. Kells, Yuba City, showing method of pruning most generally adopted throughout the State.

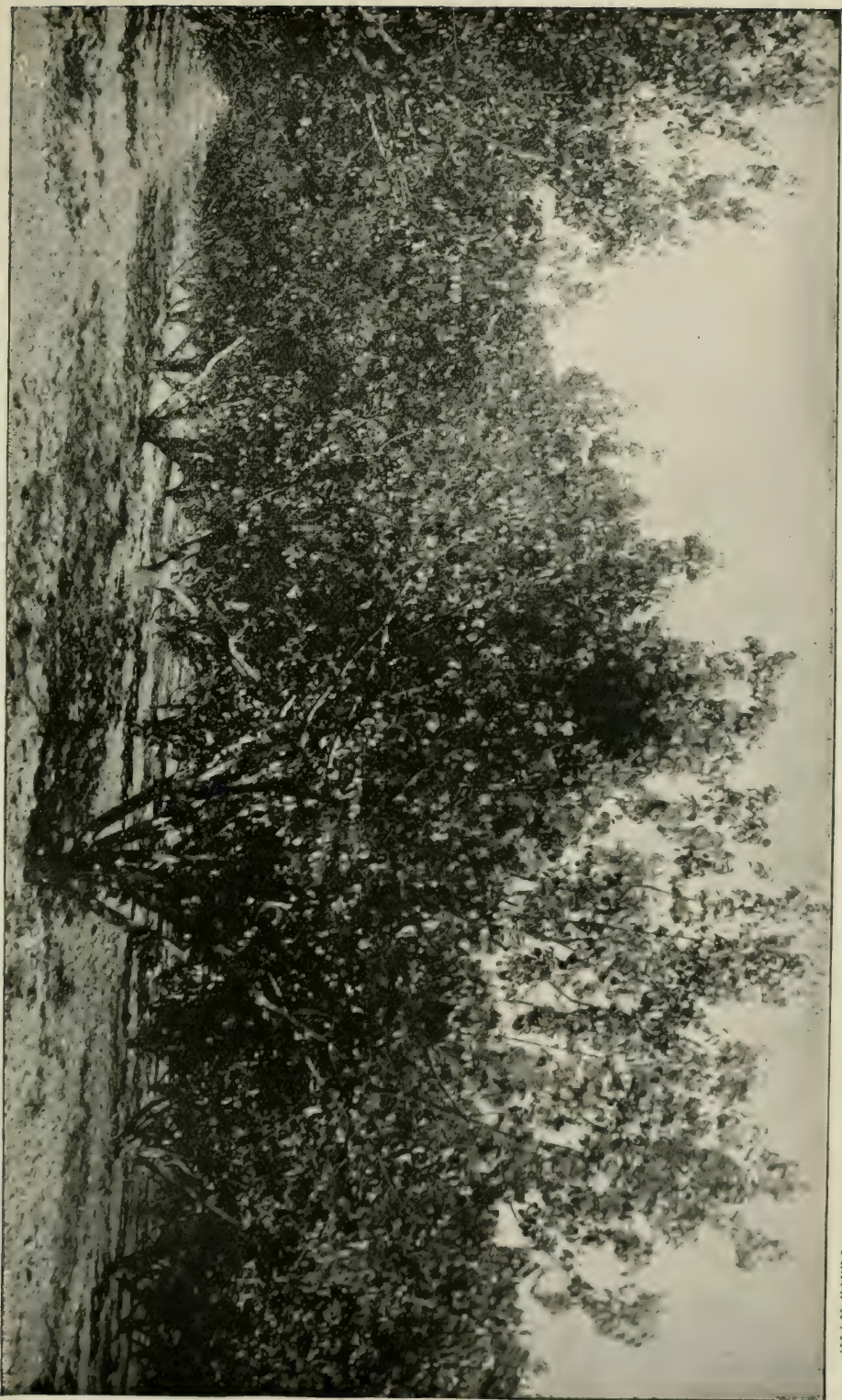




Row of St. Ambrose Apricot trees (4 years old) in orchard of Hatch & Rock, Biggs, showing method of pruning.







Apricot trees in full bearing, showing best method of pruning.





toward the light it is almost transparent. If the skin is not bleached to match the cut surface, the halves will curl on the edges, making the fruit seem much smaller. Too green fruit will do this anyhow, and will not bleach.

I generally allow five pounds of sulphur for a ton of green fruit. Each time I sulphur, I have my trays piled right by the place where they are to be spread on the drying-ground. When their hour is up, off comes the box to go over the next pile, and then the sulphured trays are spread out to the sun. It is a curious fact that one can get the box too tight. There must be a little ventilation in the upper part, so that the gas can replace the air, or else the bleaching of the upper trays will be incomplete; also have your pan of sulphur on that end of the box which is toward the wind.

By Ellwood Cooper, of Santa Barbara.

The sulphuring, in the process of curing or drying fruit, has been very largely discussed of late. It is claimed by some that there is danger of poison; from others objections are made from a moral standpoint. The remarks, however, are mostly made from statements without foundation in experimental facts. I have taken some pains to investigate what does result from the fumes of sulphur. I give below the statement of an analytical chemist of Philadelphia, a warm personal friend, to whom I wrote for information:

"Sulphur, when burned, combines with the oxygen of the air, forming sulphurous acid, a combination of one of sulphur with two of oxygen. It is a gas, and passes up among the fruit practically unchanged. Sulphurous acid is further oxidized by the action of air and moisture, forming sulphuric acid, a combination of one of sulphur and three of oxygen. This last process is, however, slow, unaided by stronger oxidizing agents. The quantity, therefore, formed in the process of fumigating, would be very small and hardly appreciable, and what little would be formed would enter into combination with the fruit and not be in the free state. The effect of sulphurous acid on vegetable and animal matter is manifold. The changes that concern your present inquiry are as follows:

"*First*—Bleaching, caused by the deoxidizing of the coloring matter contained in the fruit. In this action, the sulphurous acid combining with the oxygen of the coloring matter forms sulphuric acid, which combines with the vegetable matter of the fruit.

"*Second*—Sulphurous acid has the quality of combining with nitrogenous organic compounds (albuminous bodies) contained in the fruit, and preventing the decomposition of these easily decomposed bodies, thereby preserving the fruit in an unaltered condition. Sulphurous acid is therefore an antiseptic. Furthermore, the presence of a small quantity of sulphurous acid in the fruit aids in its preservation by preventing the action of parasites. In fine, the presence of sulphurous acid destroys spores and prevents the formation of fungi, thereby checking putrefaction and fermentation. The process of putrefaction is a complicated one; it may be considered as a slow combustion, commencing when fungi forms on the surface, with sufficient access of air. The fungi appears to transfer the oxygen of the air to the body; oxidation takes place, converting the elements of the body into carbonic acid, water, and ammonia. By alcoholic fermentation the sugar of the fruit is split up into carbonic acid and alcohol. I have examined some dried fruit from California, with the view of determining whether any free sulphuric acid was contained in the fruit. The result of my examination proved the entire absence of free sulphuric acid. There was a fraction of 1 per cent of sulphuric acid in combination with the fruit, amounting to only .05 per cent. I am of the opinion that the fumigating process, instead of being injurious to, or leaving any poisonous substance in, the fruit, is, on the contrary, beneficial, improving the quality of the fruit by preventing the formation of substances more or less injurious to health."

#### DRYING.

How long the fruit must be exposed on the drying-ground will, of course, depend upon the state of the weather and the condition of the fruit. In locations where the apricot thrives best the conditions are not always most favorable for its preservation. The atmosphere near the coast carries a greater percentage of moisture than it does farther inland. In Ventura County, where apricots are very largely grown, the producers ship their fruit to Newhall, a distance of fifty miles inland, where the hot desiccating winds, devoid of moisture, offer perfect drying conditions, and here is maintained the largest apricot drying-ground in California. Ordinarily it is unnecessary to cover fruit during the drying season. In locations, however, where fogs are liable to come in the night or on rare occasions of summer showers, the trays are gathered in piles from thirty to fifty each and covered. Ordinarily the fruit can be left until it is

sufficiently cured, and this condition is reached when it feels thoroughly dry to the touch, yet soft and pliable; it must not be overdried or left on the trays until it will rattle. When sufficiently dried the trays are gathered up and the fruit scraped from the trays into sweat-boxes, where it can be left for twenty-four hours or more. What little moisture is left in the fruit thus is thoroughly disseminated, and the whole mass becomes uniformly tough and pliable.

By Arthur J. Towner, of Santa Ana

Do not expose the cut fruit to the sun till after the sulphur-bath. I do not cover my fruit at night while it is drying, neither do I think it necessary to look my fruit over to select out that which is dry. If some dries before the rest I let my trays stand till all the fruit is dry; then I leave them out over night to gather moisture to soften them. Early the next morning I examine the fruit. If moistened just right—that is, pliable but not sticky—stack the trays immediately, covering the top tray with an overturned tray. If the fruit be too moist let it lie in the sun till it is just right; then stack, and have them put into the sweat-boxes the same day. Of course, I speak for my locality, where we have light fogs, which are really a help in curing the fruit.

#### SWEATING.

The fruit is exposed on the drying-ground until its moisture has become sufficiently evaporated to permit its being packed without danger of decomposition. This is indicated by its condition. It should be soft and pliable, tough but not moist, nor should it be left so long exposed that it will rattle. The trays are then collected and the fruit is placed in piles, the graded sizes being kept by themselves, and left to sweat. This process requires from two to three weeks, and the fruit should be carefully watched in the meantime to prevent molding or decay. If the fruit has been uniformly dried there is little danger to be apprehended from this, and ordinarily the fruit need not be disturbed until it is time to sack it. Some driers sweat their fruit in rooms provided for the purpose, and it is dumped in great piles on the floors; others put it into sweat-boxes and leave it there until properly cured.

By Arthur J. Towner, of Santa Ana

Here comes the "scraper" with his 2x4 piece of steel (cabinetmakers' wood-scraper), and scrapes the "cots" into the boxes. There they stand for twenty-four hours or more—to sweat even; that is, lose all chippiness, and get the uniform waxiness, which, with its translucence, makes the dried apricot such an attractive fruit to look at, and very palatable also, uncooked. But remember, *all* the trays must have been thoroughly dried before this moistening and sweating process, or the curing is not well done and the fruit will ball in the packing, mold and spoil. In the sweat-boxes and till sacked, the fruit must be kept tightly covered from the moths. With average drying weather the apricot will sun-dry in four days. Excessively hot weather scalds the fruit. Breezy, moderate weather is the best.

#### PACKING DRIED FRUIT.

As much care is required in packing fruit as is demanded in any other stage of its preparation for market, and the careful drier will have a heavy, well-cured fruit, retaining all its best qualities, yet thoroughly preserved, and salable at a good price; while another will have a light fruit, which will bring a smaller price and will not net nearly so much from his orchard. In fruit growing, curing, and packing, care and attention at curing time means dollars and cents at the end.

The standard boxes hold 25 to 50 pounds. These should be lined with white paper and faced with a sheet of oiled paper. The first layer is of carefully selected fruit, nicely arranged, with cut side down. Upon this

layer the fruit is carefully arranged until the box is filled; then a layer of selected fruit is arranged as in the first layer, but with cut side up; the whole is put under a press and pressed tightly in place, after which the top is nailed on. When the box is opened the fruit at either side presents a very handsome appearance.

The greater part of the dried fruit of the State finds its way to the Eastern jobbers in sacks. These are made of white cotton and hold from 75 to 100 pounds each. In the East the fruit is either sold direct from the sacks or boxed and packed there. This gives great saving in the cost of packing and freight.

By Arthur J. Towner, of Santa Ana.

For sacking dried fruit, use a stationary box, fashioned to act as a funnel, and raised about 36 inches from the floor. There are hooks about it on which to hang the bags. Dump the fruit through the wooden funnel in not too big quantities at a time, for the bags must be jumped, and bounced, and crowded with your hands now and then, to make it pack solid. Well shaken, they will average 85 to 95 pounds to the bag, regulation size, *i. e.*, 20x36 inches. I use soft-laid twine, No. 9, and a big darning-needle for sewing up the sacks. This twine sells generally at 35 cents per pound, and one half pound is ample to sew 100 sacks. Sacks cost 8½ to 10 cents apiece. When I have made them at home they cost 7½ cents per sack. I buy "Lawrence Mills L.L." A bolt of 50 yards makes about 44 sacks. In cutting allow one inch for seams, *i. e.*, cut 41 inches for a bag. We use No. 30 thread and No. 3 needle on our New Home sewing-machine. Two spools of thread will make up a bolt into bags. A bolt of 50 yards will sack about two tons of dried apricots, packed tight. Those who have the handling of the sacked fruit much prefer the bags should be so full there will be no "shucking."

My orchard dries five pounds of green fruit to one of dry. Six to one is the general average, I am told. I think the difference is in the way I manage my trees and ground. I never irrigate my apricots. Some seasons, when I think too much rain has fallen for the good of the trees, I purposely allow the soil to dry out to a certain extent.

#### VARIETIES.

*Pringle* (Fig. 1, Plate VI).—The Pringle is the earliest apricot grown in the State, yet in some sections it comes in together with the Newcastle; but in the coast and bay counties there is no material difference in the time of ripening of these two varieties. Being the earliest, it is valuable for shipping and is not used for any other purpose. The fruit is quite small, is quite acid, adheres firmly to the stone, and ripens in May and June.

*Newcastle* (Fig. 2, Plate VI).—This apricot is the choicest of the early varieties, and in some sections is the first to ripen; being larger and more showy, far supersedes the Pringle. Fruit medium size, nearly round, golden yellow, with red cheek in the sun, but rarely so, except when the trees are trimmed so as to admit plenty of light. The tree is a good grower and a heavy bearer.

*Moorpark* (Fig. 1, Plate VII).—Of the varieties, the Moorpark is the favorite, owing to its size, beauty, and keeping qualities. Its one drawback is that it is a very uncertain bearer. It seems to require a humid climate for the setting of its bloom. In the bay and coast counties it seldom fails to bear; in the inland sections it seldom, if ever, produces a paying crop. A great many experiments have been made, having in view the overcoming of this fault, but none have as yet proven satisfactory. In Santa Clara County the Moorpark has fewer off years than in most parts of the State, and its advocates claim that in the size and quality and beauty of its fruit, and the bearing yield it gives when it does bear, it more than compensates for its seasons of rest. Many theories are advanced to account for these off years on the part of the



Moorpark. There are several reasons why the Moorpark is a failure some seasons: The fruit buds sometimes drop before they unfold; the blossoms may fail to set and the bloom fall, or the young fruit may attain considerable size and then drop from the tree. This is commonly known as the June drop. It is asserted that there is a constitutional weakness in the buds of the Moorpark, and that whatever will cause them to grow strong and healthy, will save the crop. To this end irrigation in the fall, after the crop has been gathered, is recommended, to force the sturdy growth of the new fruit buds; or, where this is not available, judicious fall pruning, to force the sap into the remaining buds, or careful fertilizing with superphosphates, which gives the buds vigor and health and enables them to withstand the danger to which their constitutional weakness exposes them. On the other hand, it is claimed that the trees which grow wood most rapidly drop the most, and that the cause of fruit dropping is purely mechanical, due to the wood swelling more rapidly than the fruit bud, which is forced off. Whatever the cause, the fact remains that the Moorpark in most places is an uncertain bearer; but it is also one of the largest, most popular, and widely disseminated. Color, deep red, or brownish red; flesh quite firm, bright orange, parting freely from the stone; quite juicy, with a rich and luscious flavor. It is a good shipper and valuable for canning and drying. Canners, however, object somewhat to the Moorpark, on account of its habit of cracking at the stem end, which militates against it for canning purposes.

*Royal* (Fig. 3, Plate VII).—The Royal possesses many of the good qualities of the Moorpark, with the additional one of being a more certain bearer. This variety is a very general favorite with apricot growers over the greater part of the State. It is probably the best all around apricot we have, always productive. By judicious pruning and thinning it is almost as sure as the seasons, and when properly grown the fruit is of good size, excellent quality, ripens gradually, hangs long on the tree, and is eagerly sought for canning, and makes a splendid dried fruit. The Royal is of French origin, and ripens in July, and a week or ten days earlier than the Moorpark. Skin dull yellow, with an orange cheek; flesh pale orange, firm and juicy, of vinous flavor; tree a vigorous grower.

*Blenheim* (Fig. 5, Plate VII).—The Blenheim is of a beautiful lemon color when ripe, and is about the same size as the Royal; is valuable for both canning and drying, and its flavor unsurpassed. The skin is very tender and easily broken. Fruit above medium, oval; flesh orange with a deep yellow; juicy, and tolerably rich flavor. The tree is a vigorous grower, and has abundant foliage. In many sections the trees, when young, cast most of their fruit, but this is overcome by age, when it becomes a good bearer, and the fruit seldom needs to be thinned.

*Peach* (Fig. 1, Plate VIII).—This is a very large and handsome apricot. In the Sacramento Valley, and in Sutter and Yuba Counties in particular, it holds a favorite place; in fact, it has become so popular that many growers label it "The Marysville Apricot." It is one of the most valuable for shipping, as also for canning and drying, and is much sought after. This apricot strongly resembles the Moorpark, but is much larger and more compressed. Fruit of the largest size, about  $2\frac{1}{2}$  inches in diameter, roundish, rather flattened, with a deep suture; skin yellow in the shade, but deep orange, mottled with dark brown, on the sunny side;

flesh of a fine yellow saffron color, juicy, rich, and highly flavored; stone peculiarly perforated along the back.

*Montgamet* (Fig. 3, Plate VIII).—A large apricot of French origin; resembles the French apricot in shape and appearance. So far it is very promising, and is much liked by many growers in the Sacramento Valley. Form large, compressed, reddish next to the sun; flesh orange yellow, very firm, with a perfumed, vinous flavor. Ripens in July. Tree vigorous grower.

*Sparks* (Fig. 1, Plate IX).—An apricot of mammoth size, and which has proved very popular in the Santa Clara Valley of the south. Was originated by W. W. Sparks, of Ventura. The following description of it is given in the "Venturian," of June, 1893:

The variety is the result of experiments by W. W. Sparks, an intelligent horticulturist, some twelve or fourteen years ago. It first attracted the attention of Mr. N. B. Smith, in 1886, when he purchased his present place. At that time the trees were two years old, and some fifty in number. They began to bear at three years, and at four years of age bore very heavily. From that time to the present year they have averaged 200 pounds to the tree. The tree is a fine, hearty, strong, and vigorous grower, which puts forth much new wood. The fruit is an extra size, and particularly fine for canning. In flavor it is much like the banana, with the meat clear and juicy. It requires less sugar in canning than the ordinary variety, and as a fruit to dry has no equal. It is, on the whole, a tree which recommends itself in a very marked degree, and to those who seek a good variety we know of none which promises better results. It ripens about the same time as the Royal.

Specimens forwarded to this office, and from which the illustration on Plate IX was made, were very large, handsome, and attractive. Very clear, pale lemon color, speckled, especially on the side next to the sun. Color of flesh clear yellow, with shallow cavity at the top. Pit loose from the flesh. Flavor similar to Moorpark, and meat very tender, juicy, and sweet. It has all the good qualities of a choice apricot, excepting its color (being very pale lemon color), yet this may not prove a disadvantage, especially for drying.

*Routier* (Fig. 3, Plate IX).—A very choice variety, originated by Senator Joseph Routier, of Sacramento County, and is becoming popular, especially in the San Joaquin Valley. Mr. Joshua Worswick, of Grangeville, Kings County, reports:

My trees are five years old this spring (1893), and the average yield per tree was fully 250 pounds, individual trees running as high as 400 pounds. The tree in this locality is a prolific bearer and fine grower, and as yet has never failed to produce a crop of fruit, since first introduced here about ten years ago.

The Routier does not blossom so early in the spring as the other varieties, such as the Royal, Blenheim, etc., thereby escaping the danger of frost, which in some seasons materially reduces the crop. It is also a superior apricot for drying—our chief industry in this section—averaging about  $5\frac{1}{2}$  pounds of fresh fruit to 1 pound of dried. So far as my observations go it has resisted all the scale insects, and I consider it the best apricot for all purposes in this locality. Green shipments are only an experiment with us as yet, the first apricots of this variety being shipped green this season (July). What the results are I am unable to state at this writing. Another good point about this variety is its large size, averaging almost twice the standard varieties, such as Royal, etc. The above information is from my own experience.

In shape it is very similar to the Peach apricot. It is deep yellow in shade, deep orange, mottled or splashed with red, in the sun; flesh juicy and rich, of excellent flavor.

*St. Ambroise* (Fig. 1, Plate X).—The St. Ambroise is a large and handsome apricot, resembling the Peach apricot. It is a good shipper and is also valuable for drying and canning. Along the coast and around the bay it is somewhat of a shy bearer. In the Sacramento and San Joa-

quin Valleys it bears well, but not regularly. The tree is a vigorous grower and of a weeping habit. Fruit compressed, of a deep yellow color, reddish next to the sun, and very smooth; flesh juicy, rich, and sugary.

*Hemskirke* (Fig. 3, Plate X).—This is a valuable variety and is very widely grown, especially in Santa Clara and Alameda Counties. It is a splendid shipper and valuable for canning and drying. It ripens even on both sides—a great point in canning. It somewhat resembles the Moorpark. The tree is a vigorous grower, and productive. Fruit large, roundish; skin orange, with red cheek; flesh bright orange, juicy and tender, with rich, luscious, plum-like flavor. Ripens in July.

*Large Early* (Fig. 5, Plate X).—This variety was at one time very popular in Santa Barbara and Ventura Counties. It is now superseded by other varieties, which have proved more certain bearers; nevertheless it is a choice apricot, very handsome and valuable for shipping, canning, and drying. Fruit medium size, rather oblong, compressed, pale orange in the shade, fine bright orange, slightly mottled, in the sun; flesh orange colored, rich and juicy.

*Vestal No. 2* (Fig. 1, Plate XI).—A seedling from the Moorpark; originated by D. C. Vestal, of San José. Fruit large, compressed, rich yellow color; flesh rich and juicy; valuable for drying and canning. Tree strong grower and very productive. Ripens in Santa Clara County fully two weeks later than the Moorpark.

*Jackson* (Fig. 2, Plate XI).—A seedling of the Peach apricot; originated in Fresno County. When first introduced it gave promising returns, but has not proved itself worthy of future propagation.

*Smith's Triumph* (Fig. 5, Plate XI).—This variety originated at Vacaville; is a good shipper, and valuable for canning and drying, but is now superseded by other varieties.

*Duboise's Early Golden* (Fig. 1, Plate XII).—Fruit small, roundish, with deep suture; skin smooth, pale orange; flesh yellow, juicy, and sweet. This variety was planted extensively years ago, but is not now considered worthy of propagation.

*Roman* (Fig. 3, Plate XII).—An old standard variety, once largely grown, but not so now, since the introduction of choicer varieties. Fruit small, with sides slightly compressed; skin pale yellow; flesh dull yellow, soft, rather dry.

*Beamer* (Fig. 5, Plate XII).—Fruit resembles the Blenheim; medium oval, pale orange; has little merit.

*Coulange* (Fig. 1, Plate XIII).—A medium sized apricot, of but little merit.

*Triumph de Busseire* (Fig. 3, Plate XIII).—Medium size, of little merit.

*Glori de Pourtales* (Fig. 5, Plate XIII).—A medium sized apricot, of little merit.

*Kaisha* (Fig. 1, Plate XIV).—Fruit medium; has little merit; tree tender.

*Jaques* (Fig. 3, Plate XIV).—Fruit of medium size, of good quality, but too inferior as compared to others now grown.

*Jannicet* (Fig. 5, Plate XIV).—Fruit of medium size, inferior.

*Luizet*.—A new and promising variety, recently introduced from France. Said to be of excellent quality and a good shipper.

*Purple or Black*.—"This variety is quite distinct in all respects from all others; the fruit is small, and very much resembles a plum; skin red,



covered with delicate down; flesh yellow, juicy, and pleasant; very hardy."—John Rock.

*Sardinian*.—"A small, early apricot, the first of the freestones to ripen. Skin white, spotted with crimson; flesh very juicy, with a sprightly sweet flavor; stone very small."—John Rock.

*Espereu*.—"A midseason French variety, large, of best quality."—Leonard Coates.

*Bonebon*.—"From France, of enormous size, roundish oblong, quality first class."—Leonard Coates.

*Gooley*.—"New; a seedling; said to be the earliest of all the large varieties; from Solano County."—Leonard Coates.

*Hinds*.—"Introduced by I. H. Thomas, of Visalia; large, shapely, and ripening evenly; commended for its rich, juicy sweetness."—George C. Roeding.

*Rivers' Early*.—"Resembles Large Early, but of a richer, higher flavor and smoother skin; July."—George C. Roeding.

*Musk Early*.—"A new variety obtained from south of France. Very early, with a rich, musky flavor."—Felix Gillett.

*Mexico*.—"Medium large; sweet, juicy, delicious flavor."—Felix Gillett.

*Peach of Nancy*.—"One of the best."—Felix Gillett.

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#### IV.

#### THE CHERRY.

(*Cerasus*.)

The cherry is a native of Asia. The cherry tree may be classed as one of the handsomest, as it is under favorable conditions one of the most profitable of our fruit trees. It grows luxuriantly and with great rapidity; has a smooth bark and heavy foliage. The black and heart-shaped varieties are especially vigorous, and form large spreading heads 40 or 50 feet in height. The acid or red varieties are of slower growth and do not attain so large a size. A strong illustration of the remarkable growth that the cherry will make in California, under proper conditions, and the equally remarkable yield of fruit, is furnished by the now famous Hector trees near Newcastle, in Placer County. Writing of these trees in the report of 1891, Mr. Hector gives an account of the character of the soil and the climatic conditions which have conspired to produce these phenomenal trees, and which, in less degree perhaps, may be found in other sections where cherry culture has proved profitable.

Experiments with the cherry in the hot, dry, interior valleys have not proved successful, and it is generally accepted as a fact that it does not do well there, although some varieties, where tried, have given good results.

While holding a front place among the fruit products of California, and aggregating a large amount, the cherry does not take a front rank in the volume of fruit shipments from the State, being surpassed by the shipments of oranges, peaches, prunes, and pears. However, the cherry, where grown under favorable conditions, has always proved itself

a remunerative crop, and, taking one year with another, there is no fruit that gives more satisfactory returns in the cherry regions.

Some cherries are grown in nearly every fruit county in California, but the principal cherry-producing section is found in the rich valley lands of Alameda, Santa Clara, Solano, Yolo, Butte, and Sacramento Counties. The vicinity of San Leandro, San Lorenzo, and Haywards, in Alameda County, is especially devoted to the growth of this fruit, and the larger part consumed in San Francisco is produced here.

#### SOIL.

Experience has demonstrated that the best soil for the cherry is a rich, not too light, valley land. Adobe is not so well suited for the cherry as a lighter and more friable soil. A soil containing much sand or gravel should be avoided. A loam underlaid by a sandy subsoil, or a deep loam, offer the best conditions, while a loam with a clayey subsoil is not desirable. On the foothills the light mellow soil is suitable for cherry growth, while the heavier clay soil is not. Where water stands near the surface, within 12 or 15 feet, the cherry will not thrive. To summarize, the best soil conditions for the cherry are deep loam, naturally damp, not wet, with the moisture equally distributed, avoiding dry sandy and gravelly soils.

By G. M. Gray, of Chico.

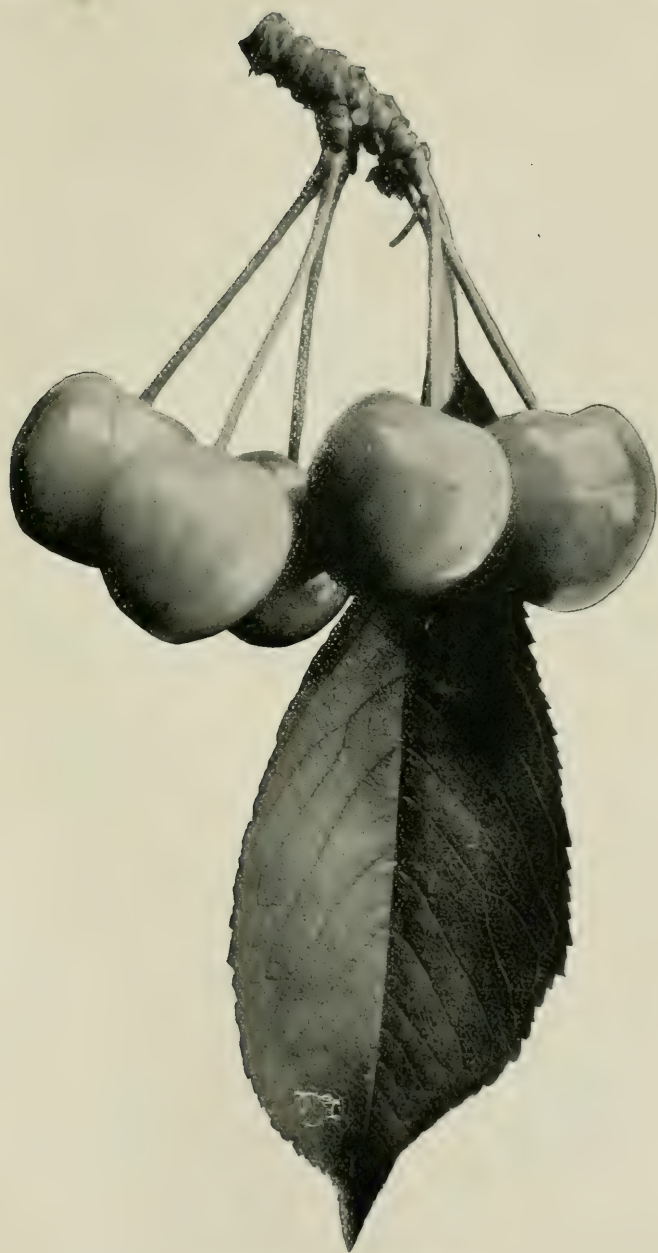
In setting out a cherry orchard select good, well-drained, sandy loam, in as early a locality as possible, as it is "the early bird that catches the worm." It is a strange fact that cherries ripen as far north as Chico a week or ten days earlier than they do a hundred miles farther south, and nearly if not quite as early as at the noted Vacaville and Winters section. Plow at least 12 inches deep; 20 inches is better. Harrow well, and stake perfectly straight in each direction; trees to be 33 feet apart. This may seem too far to those who have not had experience with old orchards. At that distance they will lap limbs before you will want to stop picking fruit from them. Dig the holes deep and broad, leaving the center of the bottom a little higher than outside. Cut off all bruised or broken roots. Spread well and tramp the richest soil firmly around the roots, leaving the dirt loose on top and a little lower than the margin.

#### PROPAGATION.

The seed from the Black Mazzard cherry produces the best stock for raising standard cherry trees. The raising of cherry seedlings is not very difficult, yet to be successful it requires considerable attention and the following of details closely. Cherry seedlings do not grow as rapidly as the peach or apricot, and the plants are seldom budded until the second year's growth. The fruit is collected when fully ripe and the pulp washed off; the pits are soon thereafter placed in boxes, covered with alternating layers of sand, and thus kept until spring, when they are planted in well-prepared seed-beds, or in nursery rows. Cherry pits start very early in the spring and should be planted in February, as soon as all signs of frost are over and the ground begins to get warm. The season following, the plants may be transplanted to permanent rows in the nursery.

After the seedlings have been planted in nursery rows, they are generally ready for budding in the following August. The bud is inserted as near the ground as possible, and from it springs a strong, straight shoot, thus insuring a good, smooth trunk for every tree.

Dwarf cherry stocks are not extensively used in this State, but in some sections they are preferred. For dwarf cherries the seeds of the Mahaleb



Royal Ann (Napoleon Bigarreau).







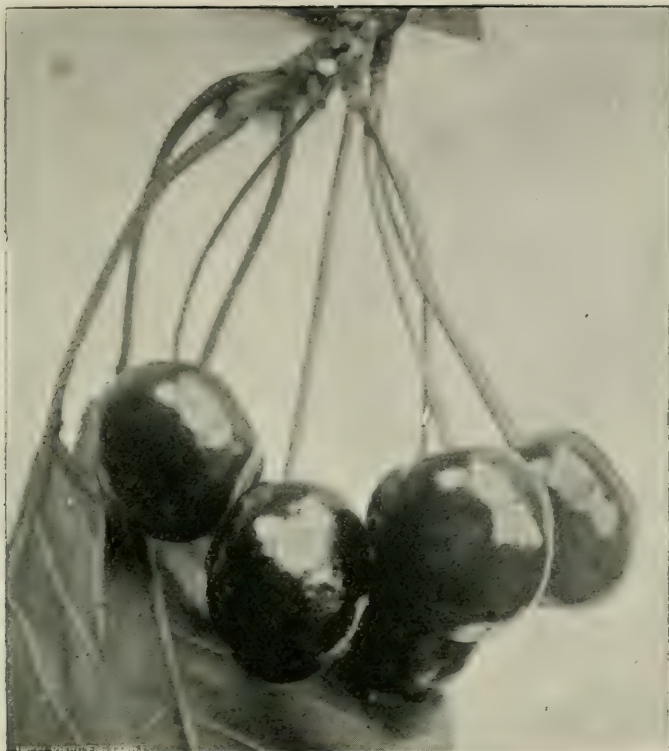
Pontiac.



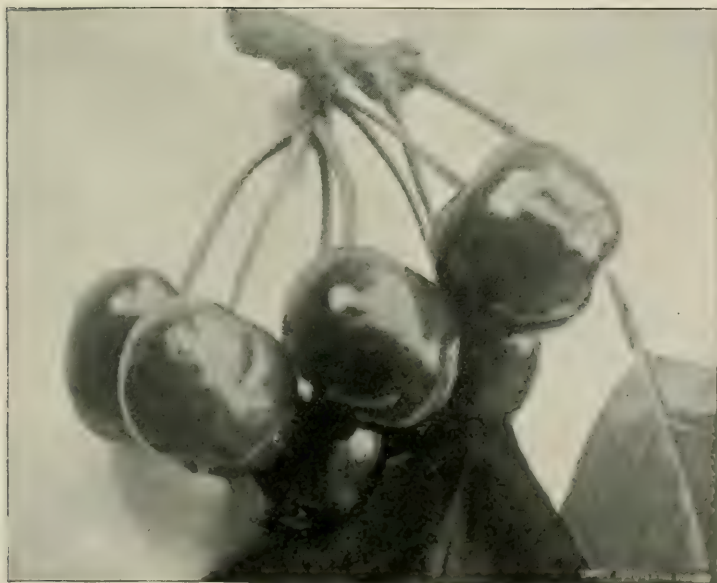
Schmidt's Bigarreau.





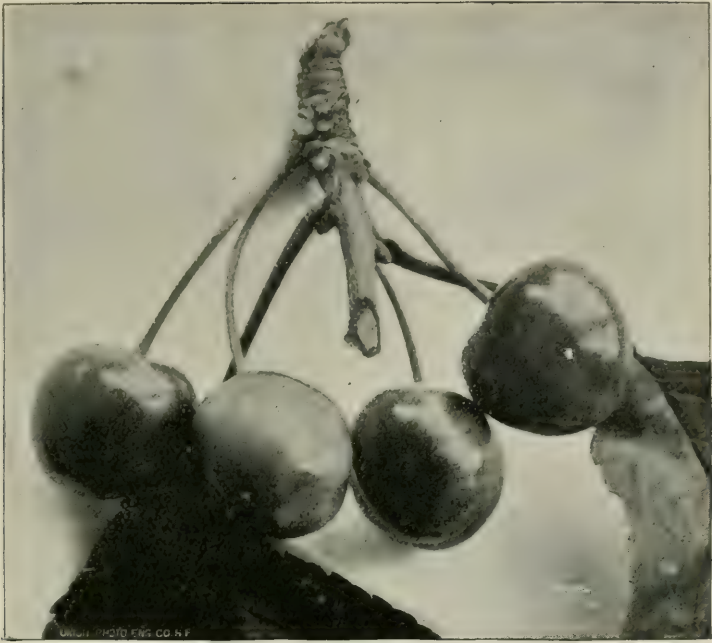


Great Bigarreau.

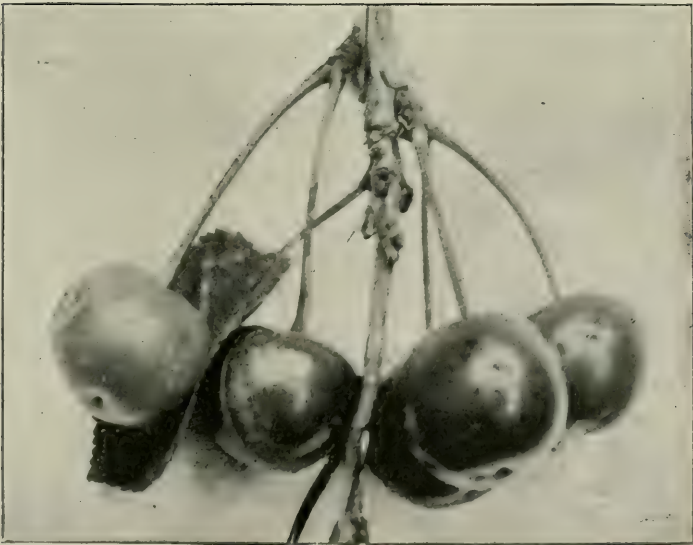


Black Eagle.





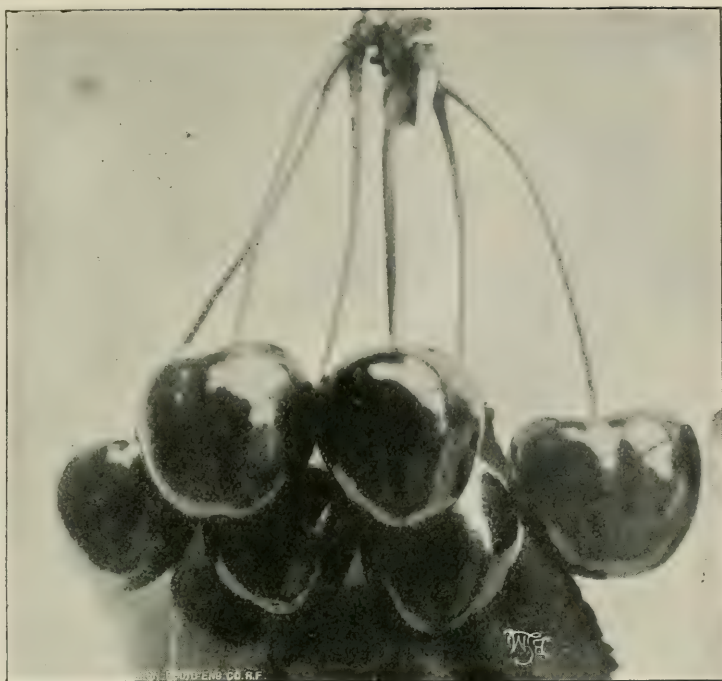
Emperor Francis.



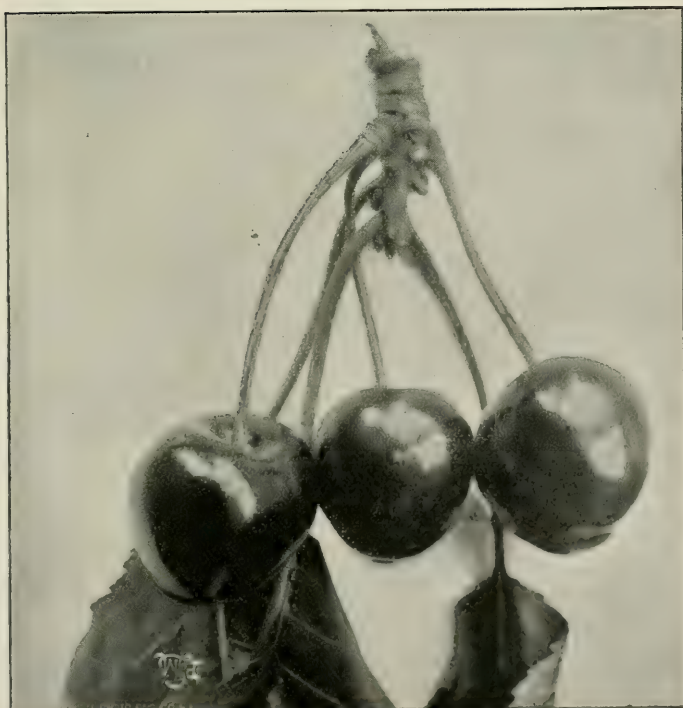
May Duke.







Black Tartarian.



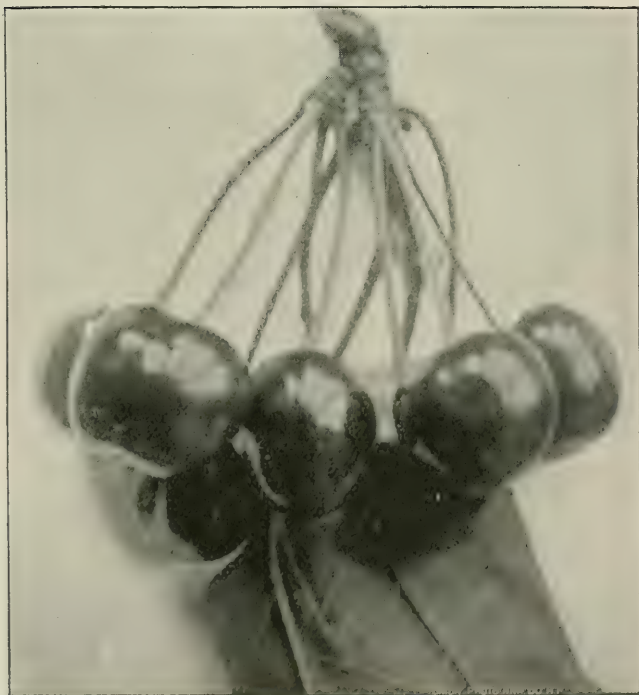
Thompson







Gov. Wood.



Lewelling.





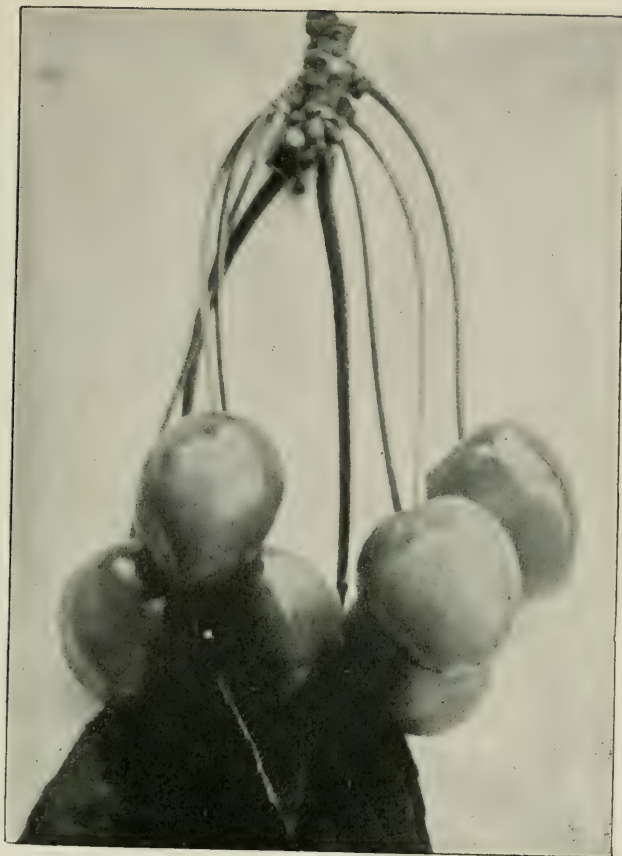
Knight's Early Black.



Werder's Early.







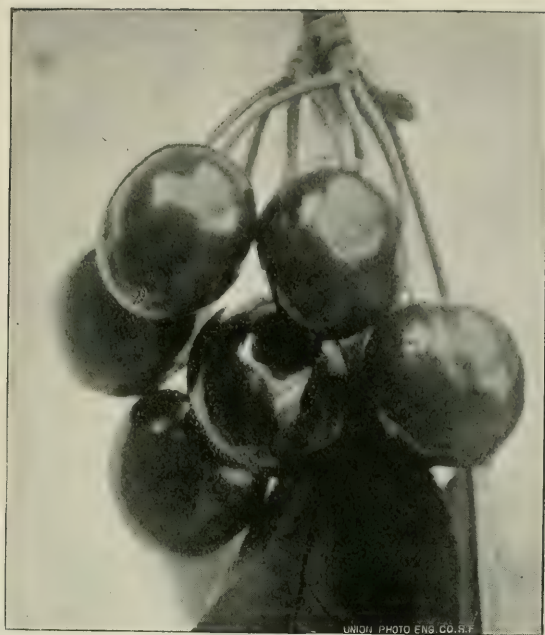
Burr's Seedling



Coe's Transparent.





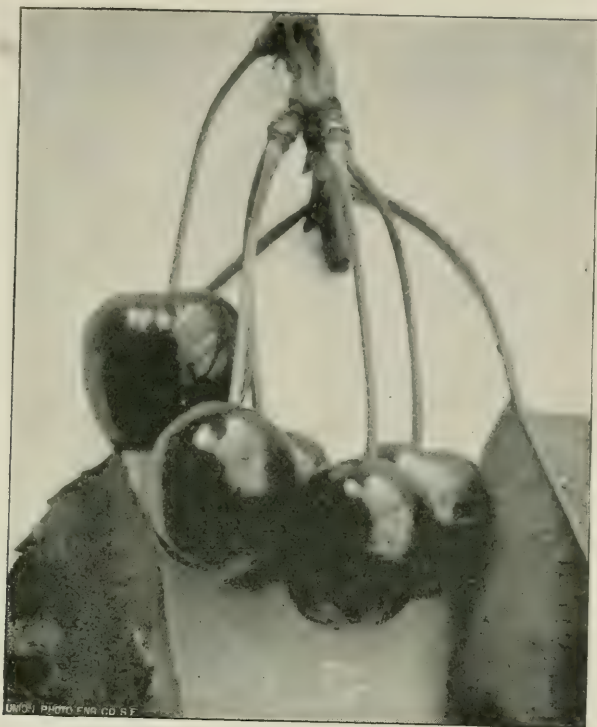


Black Bigarreau.



Yellow Spanish.





Early Lyon.



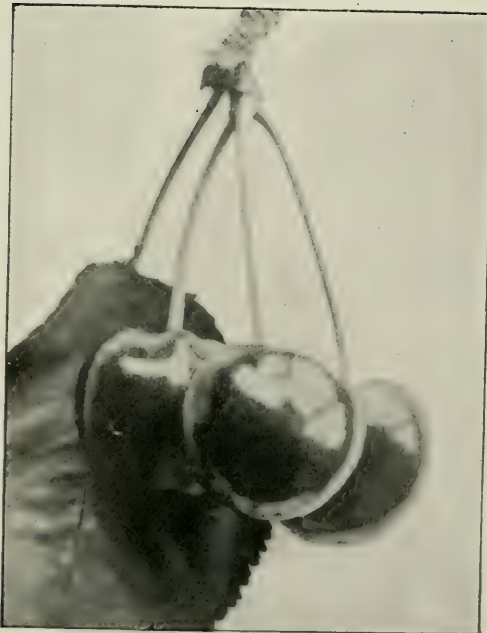
Cleveland Bigarreau.







Early Purple Guigne.



Late Black Bigarreau.







Elton.

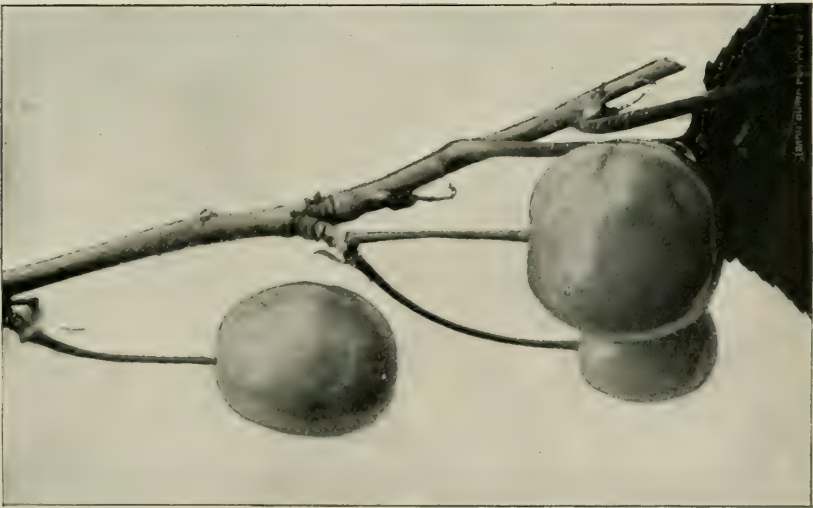


Ludwig's Bigarreau.





Centennial.



Reine Hortense.





are used, and the method of germination is the same as the one previously described for the Mazzard. The Morello stock is also considered very good, and even hardier. Dwarf species are somewhat difficult to bud into; the operation is most successfully performed late in summer, just as the stocks begin to relax in growth.

#### PLANTING AND PRUNING.

In planting, standard trees are set 30 feet apart or more. After planting, the young trees are cut off 8 to 20 inches from the ground, leaving the last bud uninjured about half an inch from the top. At the second pruning (the season following), three to five limbs, 12 inches long, should be left, cutting off all the rest. On upright-growing trees the branches should be cut to an outside bud, and on those of a spreading habit to an inside bud. At the third pruning cut back one half or two thirds, and thin out to make a well-balanced and good proportioned tree. The fourth and fifth prunings will be about the same, after which but little pruning is necessary. In cutting old cherry limbs it is necessary to cut to a crotch, as the stub will die and likely involve the life of the tree. It is also an absolute necessity to use hot wax or rubber paint on the severed limbs.

By Gilbert Tompkins, of San Leandro.

I have adopted the plan of pruning every other year; I think that is the best plan for any tree that is so apt to run to wood growth, as is the cherry on our rich land. By leaving the trees unpruned there is not that stimulus given to the production of wood, and the energy of the tree is more generally used in forming fruit wood. Downing says that the generally accepted theory of the formation of fruit wood is the ripening of the sap in the limbs of the tree. If the branches are left uncut the ripening process goes on much faster than when the growth of the tree is perpetually stimulated by the cutting of the branches.

By G. M. Gray, of Chico.

Immediately after setting out, cut off your trees 2 feet from the ground, at an angle of 45°, leaving the last bud uninjured, about one half inch from the top; cover the top with hot wax; cut all side limbs. At the second pruning leave three, four, or five limbs, 12 inches long; cut off all the rest; cut to an outside bud on the upright-growing trees, and to an inside bud on the natural, spreading tree. At the third pruning cut back one half or two thirds; then cut to make a well-balanced and good proportioned tree. The fourth and fifth prunings will be about the same. After that very little pruning will be necessary, except cutting out broken limbs, or where they rub or lay in a mat. In cutting old cherry limbs always cut to a crotch, as stubs will die and often kill the entire limb. Be sure and remember the hot wax; it is not necessary on some kinds of trees, but it is on cherry.

#### CULTIVATING THE SOIL.

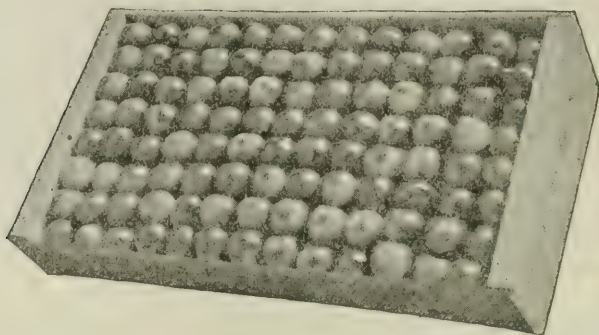
The cultivation required depends very much upon soil and conditions. Some of the most successful orchards are plowed two or three times a year, and cultivators and weed knives are used whenever needed. In looser, more sandy soil, less plowing and cultivating will be required. One of the principal objects in plowing is to form a deep mulch to hold the moisture. Where plowing is neglected and shallow cultivation resorted to, the surface mulch is thin and the moisture of the soil evaporates much more rapidly.

By W. C. Blackwood, of Haywards.

As a general rule, I would say plow your orchard, and if your soil is deep, plow deep and cultivate afterwards with the harrow or cultivator, and allow no weeds to grow. I have had a little experience in that. I purchased a little farm down near Mountain View some time ago, and agreed with the man from whom I bought to take care of the orchard, and about six weeks or two months after I visited the orchard and there was not

a weed in it. He seemed to have done very well, still there was something about it I didn't like, and I went to a neighbor having a little orchard adjoining, and saw that his trees were about as large again as the trees in my orchard. I said: "How long have you had this orchard?" He said that he had been there a year; that his trees came from the same place as mine, and were planted about the same time. I asked him how it was that his trees had made so much better growth. He answered: "He did not plow his orchard and I plowed mine;" and that settled the question in my mind. Now, I agree that there are lands where plowing need not be done. Land that is probably moist does not need much cultivation or much plowing; but on dry soil, whether it be loam or gravel, I hold that it is best to plow, and if your soil is deep, plow deep.

#### PICKING AND PACKING.



A box of cherries properly packed for shipment, the fruit being arranged in layers.

The picking and packing of the cherry is one of the most important matters in the cherry orchardist's work. The fruit may be extra fine and particularly attractive, yet if carelessly handled in the picking and packed without taste, it will not sell so readily nor bring as good a price as an inferior article properly handled. There is a great difference in the speed with which pickers work, and while some make a toil of picking twelve boxes a day, others with less apparent labor will double this amount. In packing the fruit for market the greatest care must be taken in sorting and facing the fruit to make an attractive display.

The usual packages for cherries hold ten pounds each. These are slipped into chests of twelve each, or packed in crates of four.

The packing is usually done in a tin form, which slips into the box. In this the first layer is carefully arranged in rows with the stems up; upon this layer the other fruit is placed, without regard to regularity, until the form is filled, when it is gently pressed down, not sufficient, however, to injure the tender fruit. The box is then slipped over the tin form and the whole turned over, when the form is removed and the cover is nailed on the box and it is slipped into the chest or crate for shipment to market. Throughout the whole process of picking and packing the greatest care must be exercised so that the tender fruit does not get bruised or damaged.

By G. M. Gray, of Chico.

The picking and packing of the cherry are the most important parts of the business, as carelessness in handling will surely bring ruin, and a clumsy-fingered picker will make them cost a large part of the selling price. I am satisfied we shall have to invent some better way of packing cherries before we shall succeed in shipping to distant parts. The common cherry box will do for all points within four days, but very few that have been shipped more than that have paid expenses. The greatest of care must be taken in sorting and facing to make an attractive and satisfactory package.



## DISEASES AND PESTS.

One of the greatest pests the cherry grower has to contend with is the gopher, which evinces an especial fondness for the cherry tree. As the work of this animal is below the surface and out of sight, it is difficult to know the damage he is wreaking until it is beyond remedy. Many large trees in all parts of the State have been girdled by this pest, and the first intimation their owners had of this work was given by the withered leaves and the death of the tree. The best remedy is trapping them, for which several traps have been invented. Another remedy for the gopher is to dig down into his runway and leave there a raisin or a small piece of carrot or celery root, which has been split, and a particle of strychnine inserted. The gophers are very fond of these and will eat them.

Of diseases to which the cherry is subject the principal is the gum disease, in which from some cause the sap oozes through the bark and condenses on the limbs in the form of round masses of gum, sometimes of considerable size. These, unless removed, sometimes induce decay of the bark and wood, and so prove injurious to the tree. Where this disease manifests itself the best remedy is to pare away the outer bark with a sharp knife and cover the wound so made with a varnish of shellac and alcohol. Where the gum accumulates in the crotch formed by the junction of two limbs, as it frequently does, it should be cleaned out, or it forms a receptacle for decaying organic matter, which will cause the tree to decay at the point of lodgment.

## VARIETIES.

There are a great many varieties of cherries now in cultivation, and many of them find their way to the markets labeled "Black" and "White," but it would be of much value to horticulturists if the correct names were given. In the illustrations herewith appended are many illustrated for the first time, as are a number of pits, to show the different types from an educational standpoint and for classification purposes; also to show their bearing qualities. Among the most popular varieties are a number of old standard sorts, and some of the best have been produced in our own State.

The *Royal Ann* (Napoleon Bigarreau) is the most popular white cherry and brings the highest market price, as it is valuable for shipping and for the table, canning, and cooking. As all fruits have drawbacks, this cherry has one great fault. It bears well only in situations peculiarly adapted to its growth. In some sections the tree requires age before it gives a paying crop, yet in others it does so well that it is very largely grown. What the exact conditions are that this tree requires is difficult to tell and can only be acquired by experience in its culture.

The *Black Tartarian* is the most popular of all cherries and is most largely grown. It is a handsome cherry, and the tree a most beautiful grower and by far the most symmetrical. The fruit before ripe is red, and in this state of ripeness is largely shipped quite early in the season and finds quick sale. The fruit is used for many purposes. It has a good market for shipping, canning, and drying.

*Early Lamaurie*.—This is the earliest cherry in the State. Fruit large, dark purple. Flesh juicy, excellent.

## EXPLANATION TO PLATE XXXII.

## TYPES OF CHERRY PITS.

- |                                  |                               |
|----------------------------------|-------------------------------|
| 1. Early Richmond.               | 17. Late Black Bigarreau.     |
| 2. Thompson's Seedling.          | 18. Large Black Bigarreau.    |
| 3. Ludwig's Bigarreau.           | 19. Monstrous de Megel.       |
| 4. Napoleon Bigarreau.           | 20. May Duke.                 |
| 5. Werder's Early Black.         | 21. Yellow Spanish.           |
| 6. Pontiac.                      | 22. Bohemian Black Bigarreau. |
| 7. Early Lyon.                   | 23. Elton.                    |
| 8. Coe's Transparent.            | 24. Knight's Early Black.     |
| 9. Centennial.                   | 25. Cleveland Bigarreau.      |
| 10. Grosse rote Knorbel Kirsche. | 26. Reine Hortense.           |
| 11. Black Eagle.                 | 27. Black Tartarian.          |
| 12. Schmidt's Bigarreau.         | 28. Beaumann's May.           |
| 13. Emperor Francis.             | 29. Guigne Mabrea.            |
| 14. Lewelling.                   | 30. Guigne tres précoce.      |
| 15. Early Rivers.                | 31. Burr's Seedling.          |
| 16. Governor Wood.               |                               |



Early Richmond.

## THE CHERRY.

## PLATE XXXII.



Types of Cherry Pits.



The *Early Purple Guigne* is a very early sort; ranks next to *Early Lamaurie* in time of ripening, but in some sections comes in before that variety and is therefore one of the earliest to be seen in the market. Quite early in the season it is shipped when yet red and before turning dark, and brings good prices.

The *Governor Wood* greatly resembles the *Royal Ann*. It is not as good a shipper, but is quite popular with canners. It is a very sweet and handsome cherry, and is perhaps the most highly prized for the table.

The *Burr's Seedling* is another valuable early sort; is a good shipper, and brings good prices.

The *Black Eagle* is a very handsome cherry; resembles *Black Tartarian*.

The *Lewelling* is another valuable sort, both for shipping, canning, and drying.

The *Thompson's Seedling* is one of the best black cherries grown and is very profitable in sections adapted to its culture. In the Alameda and Santa Clara Valleys it does remarkably well and is highly prized.

The *Centennial* is a valuable shipping cherry. It greatly resembles the *Royal Ann*, but is not so bright in color. It is a good bearer and a fair grower.

The *Yellow Spanish* is a beautiful, bright yellow cherry, and very popular for canning.

For cooking, the *May Duke* and *Early Richmond* cannot be surpassed; these are well known varieties.

Cherries are divided into four general groups, two of the sweet and two of the acid class. These are the *Bigarreau* and *Hearts* of the former and the *Dukes* and *Morellos* of the latter. The varieties in each of these groups merge one into the other, until it is often difficult to distinguish between them. The former group are characterized by the vigorous growth of the trees. The *Bigarreau* are firm fleshed, white, yellow, red, or black in color. Of these the *Napoleon Bigarreau* and *Yellow Spanish* are types. The *Hearts*, usually heart-shaped, have a softer, sweeter pulp than the *Bigarreau*, but are of the same color. Of this class the *Black Tartarian* and *Early Purple Guigne* may be taken as samples.

The *Dukes* and *Morellos* include the acid varieties, and the former hold a place between the *Morellos* and the *Sweets*. The trees are small and generally of an upright growth. The fruit is generally acid or sub-acid, though the sweetest cherry when ripe, the *Belle de Choisy*, is placed in this sub-group. The *May Duke* is a type of this group. There are some very fine dessert cherries among them, if allowed to become fully ripe. The trouble with the *Dukes* is that they are rather watery and tender for cooking, too soft for shipment, and rather acid for dessert use. The *May Duke*, however, comes near being an exception. It is highly prized everywhere, and especially where the climate is a little too cold for the sweets.

The *Morello* group comes last. These are usually small, round-headed trees, with slender, drooping branches and small, thick leaves. This group is divided into two sub-groups, one of which is the *Kentish* or *Early Richmond*, *Early May*, etc. It is a small, round, red, soft, acid fruit. It ripens early and quickly. The fruit, though watery, is highly esteemed for cooking and canning. There are several better, though later, cherries in this group than the *Kentish*. The *Montmorencies*

belong in this group. Their foliage is smaller than either of the other groups. These are the renowned cherry pie-fruits. They are very dark red—nearly black—mostly round, quite firm in skin and flesh, and very acid. Some of them are very rich when fully ripe. They ripen very slowly, and are used for pies weeks before they are ripe. The common Black Morello, the type of the group, is the hardiest and healthiest of our old varieties of cherries. Some of the varieties of this class are red and light red, but none are as good as the common Black Morello. The black English Morello is the largest of the class. The tree is small, conical, enormously productive, late, and very acid, much like some of the plums and American gooseberries—so acid that sugar will not sweeten them.

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## V.

### THE POMELO.

(*Citrus pomelanus*. Syn., Grape-Fruit.)

The pomelo is a variety of the shaddock. There are many varieties in cultivation, and of late have met with great favor in the Eastern markets. The fruit of most varieties vary in size, are generally large, and weigh all the way from half a pound to five pounds. The color resembles that of the citron. Skin very smooth, pulp sub-acid. The tree is very ornamental, has large, deep-green foliage; is semi-dwarf, and a native of China and Japan. There is practically only one variety so far known in the market, and that is the sour, bitter-rind variety. As yet the improved varieties have no commercial standing, because enough have not been grown to make a shipment that would produce an impression. The specimens of the improved sorts I have examined far excel the old-fashioned, sour, bitter-rind variety.

However, the medicinal qualities of the pomelo have suddenly brought it into great favor. Ten years ago there was no sale for this fruit, and it was permitted to go to waste. Now they sell readily for from \$2 50 to \$5 per box, with a steady demand. The pomelo was used for many years in hot climates to correct acidity of the stomach, and other troubles of the digestive organs. For the past dozen years physicians have prescribed them for invalids with disordered stomachs, and in many cases they are a panacea. Many cases are reported here of persons suffering with disordered stomachs being cured in one to two months by the use of the pomelo, and in Florida hundreds of cases are reported.

In a paper read before the Florida State Horticultural Society, O. M. Crosby, of Avon Park, said:

Passing through upper Broadway, New York, a few years since, after a happy winter in Florida, I noticed a huckster with a wagon-load of now popular, then unknown, grape-fruit, or pomelo. He wore a discouraged look as he came out of the houses with samples of fruit which he vainly offered for sale. His countenance lightened as I asked, "How much are those grape-fruit?" and he replied, "Well, I am glad there is one man in New York who knows what they are. I can't sell them," and I happily carried home a sack full at the rate of "eight for a quarter."

To-day what a change, and how suddenly popular has become this almost unknown, healthful fruit. While oranges have gone begging at \$1 per box the past three months in Jacksonville, grape-fruit have readily brought \$2 per box. They thrive with less trouble, and are equally as prolific as the orange.

Moral: Plant more and better grape-fruit.

The culture of the pomelo has extended over a wide range of country, often in a wild state.

The Florida "Exchange" says:

The great value of grape-fruit is not generally known outside of Florida, although in some of the larger cities the sale is quite large and increasing. Its valuable medicinal qualities are rapidly bringing it into notice and demand. We have known its use to cure dyspeptic troubles, constipation, and other diseases of the stomach and bowels. The daily use of grape-fruit for a month will cure the most obstinate cases of indigestion and bring all the digestive organs into action. Some people do not like them at first; this is because they do not know how to prepare them for eating. It is better to eat them just before meals or with meals as sauce. Hemispheres them and squeeze out the juice into a tumbler. In this way you avoid the bitter in the rind. Some prepare them for the table by peeling them thin, dividing them by segments, then peel the segments of the thin skin (rag). In this way you also avoid the quinine. By many people in Florida they are preferred to oranges. They are always refreshing. The demand is greater than the supply, and the prices run better than oranges. It is said that the sweet grape-fruit has not got the medicinal quality found in the other kind. Whether this be true or not we do not know from experience.

Ed. Rumley in Florida "Vineyardist" gives the following method of using the pomelo:

The way to use them so as to avoid the bitter in the rind is to cut them in halves and squeeze the juice into a tumbler, or to suck it as it flows by squeezing; or to peel it and take out the sections and remove the membrane about the sections, which is easily done if commenced where the seeds are.

The Florida "Farmer and Fruit Grower" says:

People eat the pomelo as a breakfast relish for its acidity and its tonic quality—putting on plenty of sugar, however—and the sweet pomelo has no character any more than a sweet lemon has. It is a very agreeable fruit to eat, no doubt, but it is not medicine. There is no telling, however, what the vagaries of fashion may devise. The one fact you want to keep fixed in your mind is that, if you raise pomelos which are of a pale lemon yellow, superlatively bright and speckless, they will sell for good money, no matter what the variety.

The following interesting sketch of the pomelo is given by James Mott, in the Florida "Agriculturist," of November, 1893:

One naturalist (Seeman) says: "It is extremely common about the Fiji Isles, and covering the banks of the rivers." De Candolle says: "In China one species has a simple name, Yu, but its written character appears too complicated for a truly indigenous plant." It is said to be common in China and Cochin China, and that in the islands to the east of the Malay Archipelago the clearest indications of a wild state are found.

"Shaddock was the name of a captain who first introduced the species into the West Indies." The name pomelo and grape-fruit are more than likely local names given it since it came to Europe. Pome is the name of any fruit, the inside of which is divided. Webster says, "a fleshy or pulpy pericarp," which is very marked in this fruit. The name grape-fruit likely comes from the form the fruit takes on the tree, being produced in clusters, often twenty or more of the fruit in a bunch; it is surprising the loads of fruit this tree will produce. There are three distinct forms, though; while they are all shaddocks, the names of them somehow have become divided; the larger form is called pomelo, then shaddock, from the red color, both of skin and fruit. I am at a loss to know whether this was one of the distinct forms imported by Captain Shaddock, as De Candolle, in his "Origin of Cultivated Plants," makes no mention of it. While I have no data, I think its introduction is later than that of the orange, as in no case have I found the grape-fruit wild, which is the case of both the sweet and bitter-sweet oranges.

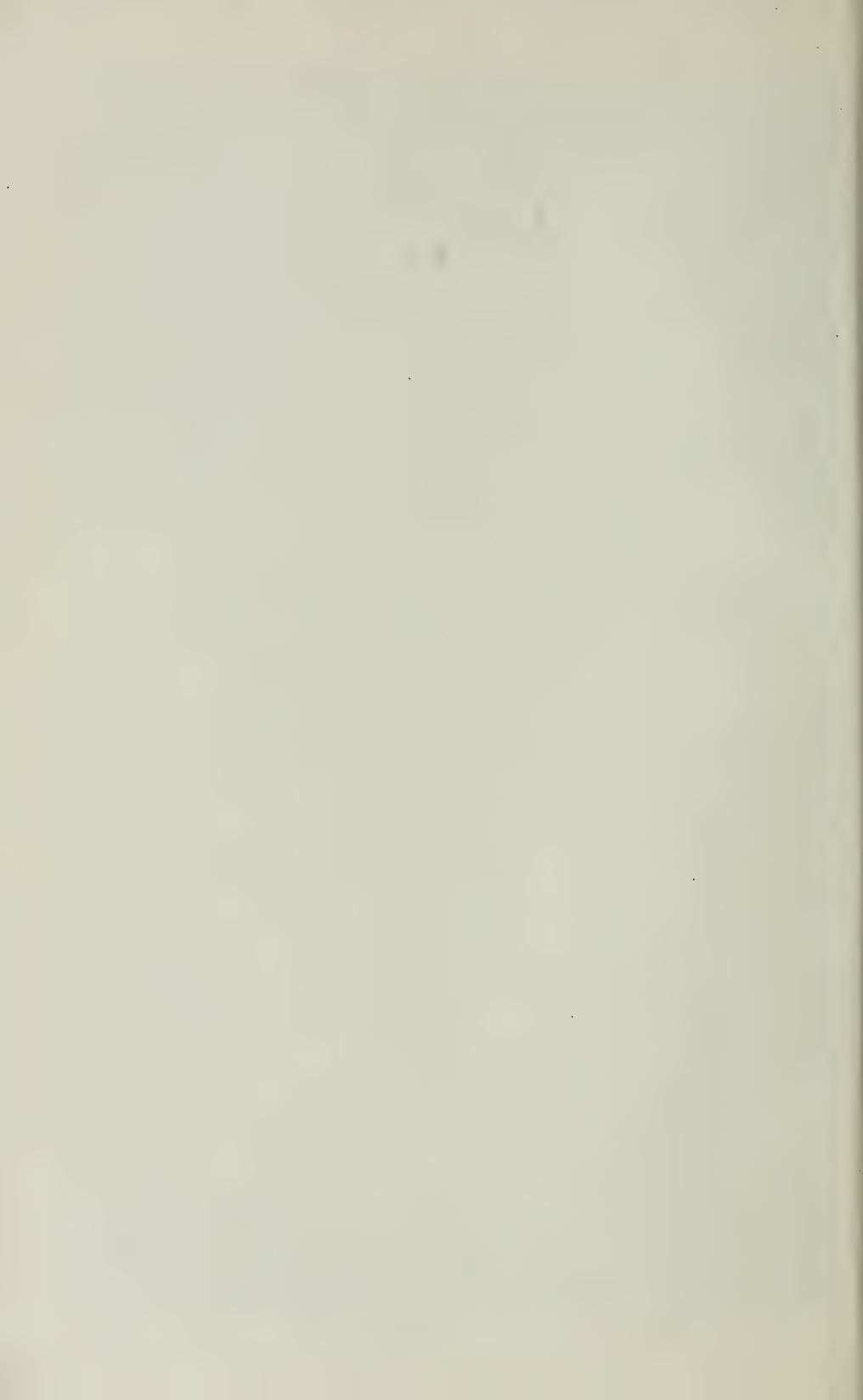
There have been several importations since the real settlement of this country, from India and other sections, but in no case have I found them to be improvements over those first introduced. There have been, however, very decided improvements of our own origin in the last decade. The form in some instances has become somewhat changed; the size less, skin thinner, with less seed and rag, and the quality changed from the pungent acid of the old form to that of a "delicious," sweet fruit. All of these, so far as I have seen, are chance seedlings, and some of them, after it was found they were better, have been more or less preserved by budding.

I am very much inclined to the belief that often they are accidentally crossed with the orange. One I might mention, the Aurantium pomelo, as the name implies, partakes of both the sweet orange and the shaddock. It is said to have been an orange tree that produced it. The trees take the form of the orange, while the fruit is produced in clusters; in form not quite so much flattened, but it is that of the grape-fruit. In quality, to many tastes, it is superior to the orange. The bitter principle of the shaddock is





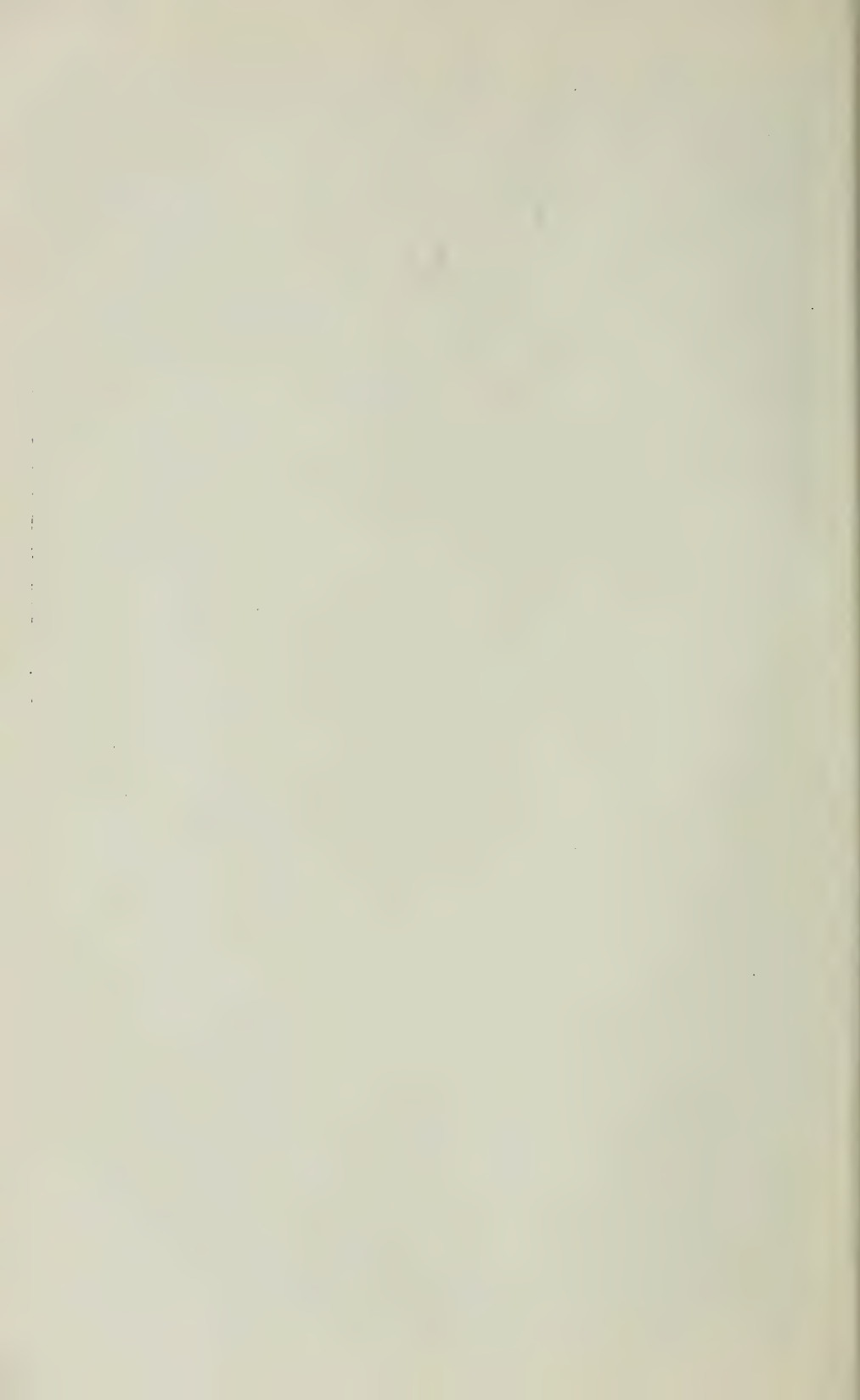
Cherry orchard in Alameda County, in full bearing, and showing method of pruning.





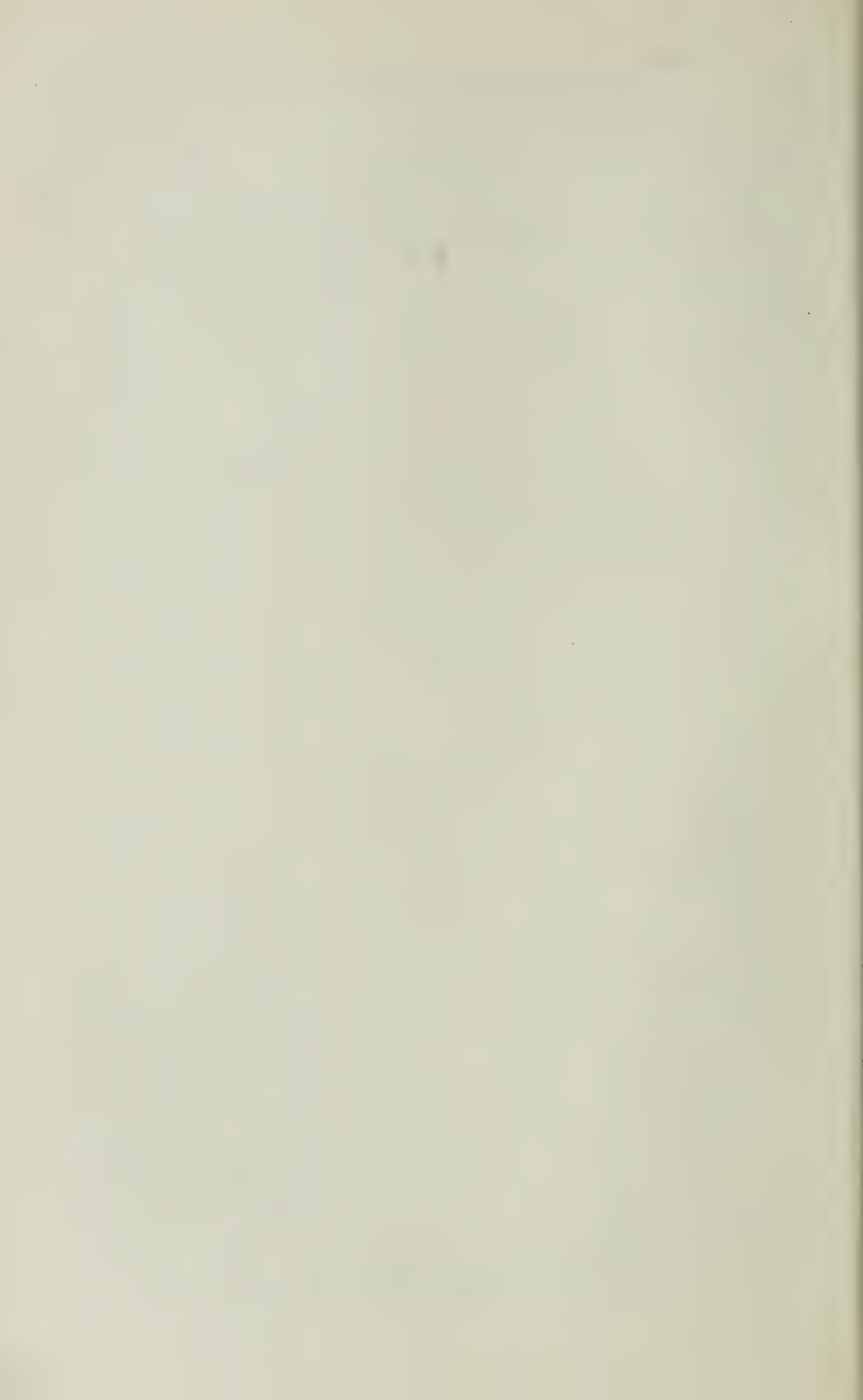
Four-year-old Black Tartarian Cherry orchard in Butte County, showing habit of growth and method of pruning.







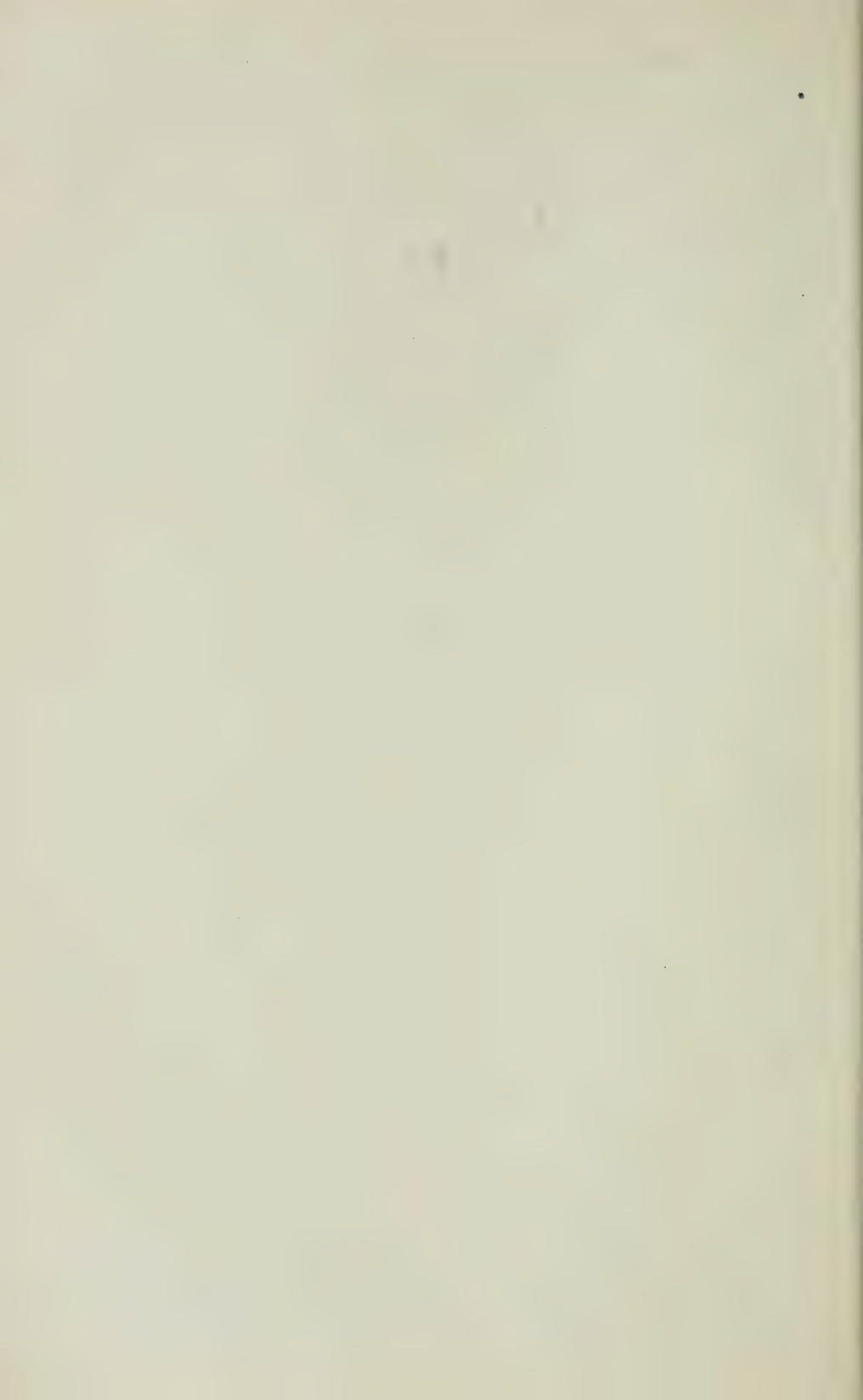
Cherry orchard in Santa Clara County, in full bearing, and showing method of pruning.







Four-year-old Early Purple Guigne Cherry orchard, showing habit of growth and method of pruning.



somewhat retained, but it is covered up with the sweets and acids, and so nicely blended that it makes a fruit more rich, with a decided tone over that of the orange.

Should I attempt to account for these changes that have come since its introduction into this country, it would be speculative, yet, I believe, correct. Our very peculiar climate, which I know in other instances has brought about pomological changes that scientists of other sections have told us could not be, has caused this remarkable fruit to become crossed with the orange, until in it we have not only the health-giving principle of the parent grape-fruit, that is so highly spoken of by our best physicians, but the luscious sweet orange of Florida.

In the markets for our oranges there is a rapidly increasing demand for the grape-fruit, and I can but believe that with the introduction of these improved varieties, the demand will so increase that it will be more sought after than our famed orange.

While one of our agents was traveling abroad, I instructed him to collect seeds of all the varieties of pomelos with which he would come in contact. He did so, and supplied me with seeds of different species. These seeds were distributed among fruit growers throughout the State for experiment, with the hope that improved sorts may be thus obtained. In all his travels he reported having found no fruit of the pomelo without seeds. My idea was that if a seedless sort could be found, I would spare no pains to have buds of it introduced and distributed throughout the State. The main objection to the pomelo is the great number of seeds the fruits contain, and a seedless sort would no doubt prove a great acquisition. While writing, the following interesting article from the Bartow (Florida) "Progress," on a "Seedless Pomelo," is handed me, which will no doubt interest many contemplating planting the pomelo:

Mr. C. M. Marsh, of Lakeland, has a new strain of grape-fruit, or pomelo, which possesses the remarkable characteristic of being seedless. Mr. Marsh is one of those painstaking fruit growers, pursuing his experiments along scientific lines, with unwearied patience and intelligent observation, to whom the State is so deeply indebted for many improvements in the quality, flavor, and variety of our home-grown fruits. This newest development promises to make for itself a foremost place among our fruits. The grape-fruit, or pomelo, is rapidly growing in popularity in Northern, Western, and foreign markets, and all who know the fruit will concede that it has qualities which fully justify its growing popularity. As at present known it is an abundant seeder. The consumer, or the cook who prepares the fruit for the consumer, finds the seeds somewhat of a nuisance, and will at once recognize the advantage of getting rid of them. When it becomes known that, with the absence of the seed, the interior skin of the fruit becomes thinner, the juiciness increases, the flavor improves, and the fruit retains all its good qualities in an enlarged degree, fruit growers will be ready to acknowledge that Mr. Marsh has got hold of a valuable thing. The matter has now proceeded beyond the range of experiment into that of certainty, as Mr. Marsh has now young trees of the new variety in his nursery that are bearing abundantly, and all true to the strain. The pulp is somewhat darker than the ordinary grape fruit, but the rind has that peculiar, bitter flavor which is so highly esteemed for medical purposes. The average size to which the fruit attains requires it to be packed fifty-four to sixty to the box.

Consul Woodrow, in his report (Fruit Culture in Foreign Countries, 1890), says:

*The Pomelo.*—Seedlings of this fruit vary greatly, and a large proportion are worthless, but the grand, thin-skinned, and red-fleshed varieties that are cultivated near Bombay are very delicious and wholesome if eaten in the morning with salt and sugar. A well developed specimen weighs 4 pounds and is 7 inches in diameter. It has 14 or 15 liths, seeds few, or sometimes none, embryo one in each seed. The tree thrives in a hot, moist climate, and needs the strongest of nitrogenous manures. Near Bombay slaughter-house offal is freely given as manure. Inarching on to a seedling pomelo is the means employed for propagation, and regular irrigation, when the rainfall is below 4 inches per month, is provided.

The pomelo is now marketed under the name of "grape-fruit," which is a misnomer. This is confusing and misleading. The name "grape-fruit" was given to this fruit in Florida, as it hangs on the trees in clusters resembling the grape, but has no relation to it whatever. Growers and shippers should drop the name "grape-fruit" and apply to it the name *pomelo*, which is popular, and botanically correct.



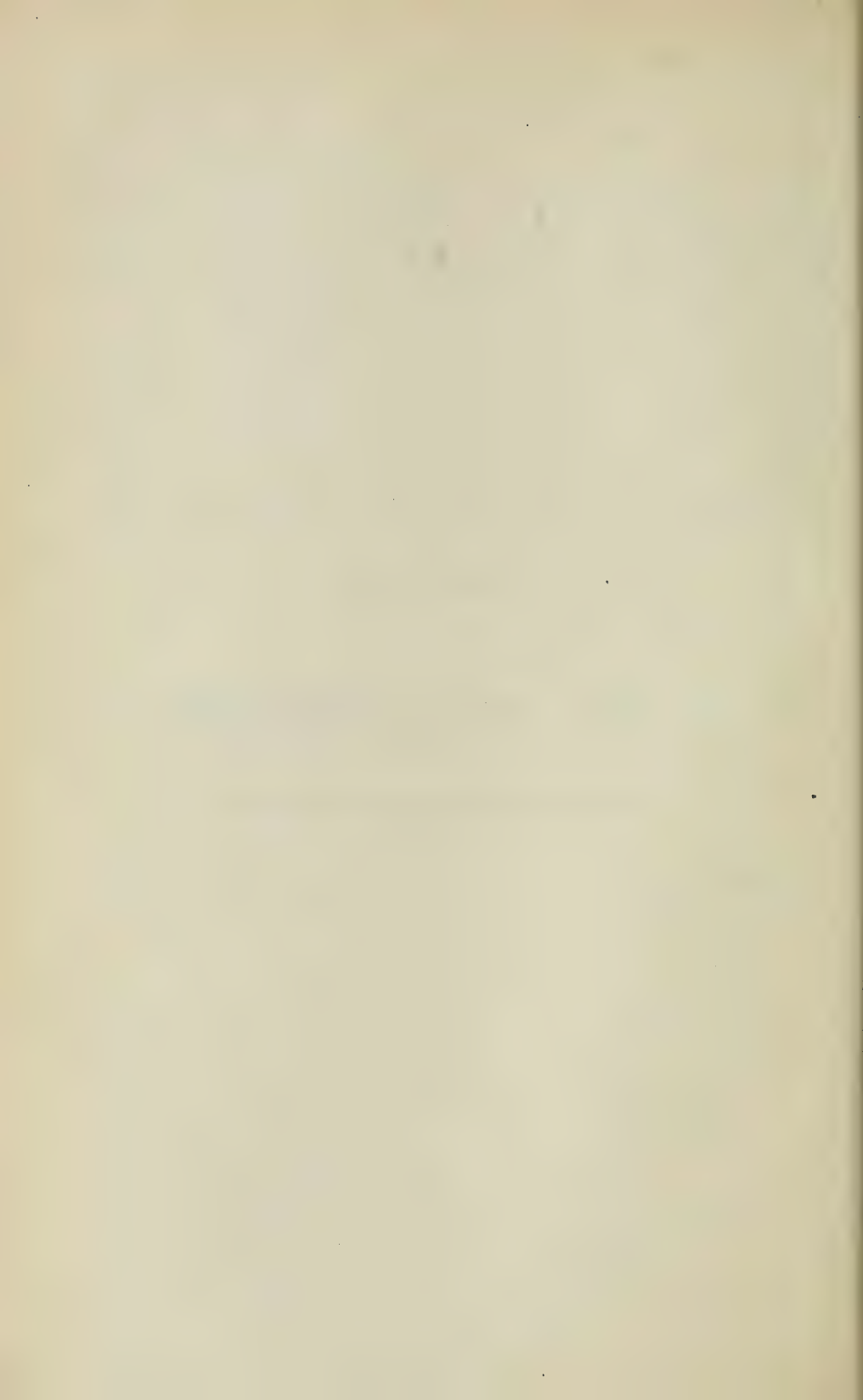


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REPORT  
OF  
I. H. THOMAS,

Commissioner for the San Joaquin District.

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## VI.

# REPORT OF I. H. THOMAS,

Commissioner for San Joaquin District.

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*To the honorable the State Board of Horticulture:*

GENTLEMEN: Herewith I submit for your consideration my report as Commissioner for the San Joaquin District, which includes the counties of San Joaquin, Stanislaus, Merced, Fresno, Tulare, and Kern, and also the newly formed counties of Kings and Madera.

It gives me pleasure to report that throughout the whole district the past season has been a very prosperous one, and while, in common with the rest of the Union, we have felt the effects of business depression and stringency in the money market, resulting in low prices for fruit, our crops have been large and our fruit of superior quality, and less complaint is heard among our orchardists than among any other class of producers. The raisin crop, which is the principal among the fruit crops of the San Joaquin district, has been especially good, and the yield much larger than the average. The season has been very propitious and enabled the growers to save both the first and second crops, both of which were large in yield and fine in quality.

The yield of deciduous fruits has been fully up to the average, and prices have averaged good. Early and late peaches, which reached the Eastern market when it was bare of domestic fruit, brought excellent prices. Those shipped, however, in the season when the Eastern fruit was ripening, did not pay so well, although, so far as I can learn, there was no loss even on those shipments.

A great drawback in the shipment of fresh fruits from the southern part of the San Joaquin district lies in the difficulty of reaching the Eastern market, and the unsatisfactory time made by the railroad. When to the promised five days' time from Sacramento, which is often extended to ten or twelve, we add the no schedule time from interior points to Sacramento, in which the fruit has to linger en route at the pleasure of the railroad employes, it will be seen that the southern portion of my district is very heavily handicapped in the green fruit market, so much so that the counties of Tulare, Kings, and Kern are practically barred from competition. As a result, the larger part of the fruit product of the San Joaquin district finds its way to market in the cured form.

The area of new land set to fruit during the past season has been very large, and much attention has been paid to citrus fruits. What is known as the "thermal belt," is a region of country in the foothills above the cold and chill of the valley, and below the frost line of the mountain regions. It varies in altitude from 500 to 2,000 feet, and in width with the contour of the country. In this section frost is absolutely unknown, and disagreeable or destructive winds infrequent. All the conditions required for citri culture are found here, and are now being taken

advantage of by our horticulturists. Extensive plantings of oranges, lemons, and limes have been made, especially around Porterville, in Tulare County, which has become the center of the citrus belt of the San Joaquin Valley. In this region lemons appear to be the favorite, and at Limekiln, Lindsay, Orosi, and other points in this thermal belt very extensive plantings have been made in the past season. These are warranted by the fact that both lemons and limes have been bearing here for years and no frost has ever yet destroyed or injured the crop, and further by the excellence of the fruit produced in this section, which carried away the first prize in competition with all of Southern California.

One great advantage possessed by this district is its comparative freedom from insect pests. The red and yellow scales, those destructive pests of the orange and lemon grower, have never obtained a foothold in the San Joaquin; the black scale cannot stand the hot days of our summer months, and the pernicious scale, the principal one which troubled us, has disappeared before the friendly parasite which has been working so assiduously upon it, that it is now difficult to find it. Among the beneficial insects at work I have especially noticed the brown-necked scymnus, the twice-stabbed ladybird, and a little chalcid fly. There are other parasites at work, and so effective are their labors in ridding our orchards of pests that little if any spraying will be done in many parts of the district this season.

#### IRRIGATION.

A matter worthy of especial note is the extension of vast irrigation works in the San Joaquin Valley. Many of the larger works have been in operation for years, and the results have been so good that new ones have been projected and the capacity of the old works enlarged. This results, naturally, in the reclamation of very large areas of arid lands, and in many instances those lands which were useful only for the production of cereals have been made valuable for fruit.

During the past year there has been organized a canal project for irrigating a large area of land on what is called the "West Side," the territory on the west side of the San Joaquin Valley, in Fresno and Kings Counties. This region is unsurpassed in the State for fertility, and will, when developed by the addition of water, become very productive and add largely to the taxable wealth of the State. Heretofore the great problem has been how to get water onto this country cheaply and successfully. As there were no streams traversing this region carrying water sufficient for the purpose of irrigation, it may be readily inferred that the engineering problem involved was very important.

The Summit Lake Water Company, composed of men of means, energy, and experience, have tackled this problem, and are now engaged in building their canals and putting up vast pumping works, for the purpose of elevating the water to a height of 20 feet, and propose, by means of a system of distributing canals, to irrigate an area of about 60,000 acres. They have had two immense centrifugal pumps constructed—the largest ever built on this coast—each having an inside diameter of 44 inches, with capacity to lift 100 gallons per second 20 feet high. They are propelled by compound condensing engines of two hundred and forty horsepower. The pumps and machinery have been made with great care by Mr. Byron Jackson, of San Francisco, a man who has had large experience in this kind of machinery. I am sure that if this enterprise proves a suc-

cess many similar ones will follow, where like conditions exist, throughout California. Fuel is cheap in the country where the Summit Lake Company are operating, and the well-known ability of the gentlemen who are conducting this novel experiment precludes the elements of uncertainty generally attendant on such ventures. I make this report for the purpose of calling attention to this kind of irrigation, as an object-lesson to those who may consider themselves unfortunate in the matter of location, that they may investigate the subject and perhaps discover a remedy for many localities heretofore thought to be useless.

Other notable irrigation works completed since my last report are the Pine Ridge Flume, east of Fresno, and a canal from Kern River to the "Weed Patch." The former was constructed for the double purpose of conveying lumber from the mountains east of Fresno and delivering water for irrigation to a large tract of rich land—some 60,000 acres in extent. The putting of water on the "Weed Patch," in Kern County, also opens to cultivation a large body of as fertile land as can be found in the State. As the greater part of all this land reclaimed by means of irrigation will in time be set to fruit trees, it will be seen that the orchard area of the San Joaquin district will be very largely increased by these enterprises.

In Stanislaus County, the joint irrigation dam of the Modesto and Turlock irrigation districts, across the Tuolumne River, near La Grange, was completed after two and one half years' work. It is the highest overflow dam in the world, being 110 feet high. At the base it is 96 feet wide, and at the top 15 feet. It is in the shape of an arch, and is 236 feet across the top. It cost about \$550,000. The dam will supply water to 276,000 acres of land in Stanislaus County. Canals on both sides have been partially finished, the total work so far costing \$1,800,000.

#### FRESNO COUNTY.

The assessment report of Fresno County, which is below the actual figures considerably, gives the following:

<i>Acres in Grapes.</i>		Bearing.	Non-bearing.
Table.....	-----	142	-----
Raisin.....	-----	25,782	12,812
Wine.....	-----	1,966	-----
<i>Number of Fruit Trees.</i>			
Apple.....	-----	8,626	6,159
Apricot.....	-----	84,930	29,139
Cherry.....	-----	376	894
Fig.....	-----	10,311	19,205
Olive.....	-----	6,317	16,386
Peach.....	-----	120,020	205,939
Pear.....	-----	47,924	63,115
Prune, French.....	-----	5,258	28,912
Prune, other varieties.....	-----	4,156	24,550
Lemon.....	-----	55	805
Orange.....	-----	429	11,957
Almond.....	-----	334	3,344
Walnut.....	-----	1,565	571
Nectarine.....	-----	104	125

These figures, indicated by the large increase in non-bearing trees, show a very large area planted to new orchards in the past two years. This is especially noticeable in the returns for oranges, figs, and olives,



to which fruits much attention is now being directed in this as in the adjoining counties. Olive culture is coming in for a very large share of attention, and the superior conditions in soil and climate and freedom from pests in this section, amply justify the faith of those who have gone into this branch of horticulture.

With regard to the characteristic industry of this county—the raisin—I have to report that this has been the best season for drying on record, notwithstanding the low temperature, and consequently slow drying. The shipments last year were 2,200 carloads of ten tons each. This year the shipment, at the date of writing, has already reached over 1,750, and conservative estimates place the crop at 2,600 to 2,700, some going even two or three hundred carloads higher.

The fig crop of Fresno this year has been large, one packing-house having shipped over 100 tons of unsulphured figs to fig syrup factories; while another has sold of his own over 60 tons, besides packing and handling large amounts for customers. As yet no figures are obtainable, but about 250 tons have already been shipped. Mr. Mitrovich has also made a large pack for Col. W. Forsyth and others in ten-pound boxes, and being an expert from the Adriatic coast has had great success. He claims the product equal to the Smyrna if properly handled.

#### BENEFICIAL INSECTS.

In answer to a letter of inquiry regarding the work of parasites in Fresno County, a prominent fruit grower there writes me: "I cannot speak too highly of the salutary effect upon the fruit industry of this county, directly attributable to the introduction of insect parasites. Your Commission has done well, and it is hoped the work will continue until we shall not be compelled to waste the net profits of our orchard crops to spray trees with expensive and unsatisfactory pest exterminators, but shall leave that work to the inexpensive parasite. The search for other pest destroyers should be persisted in, for beyond question they are the logical remedy for pests of all kinds, and that in some form or other the requisite parasite exists."

#### KINGS COUNTY.

Kings County was a part of Tulare, and was formed into a separate county by the last Legislature, and heretofore the report of the horticultural resources has been embraced in the reports of Tulare County. While there is a large acreage in deciduous fruits, the cultivation of the raisin grape is the principal industry of this county. There will be shipped from Lemoore, Armona, and Hanford about 550 carloads of raisins this season. The grade of goods ranks as high as in any part of the State, and the amount produced per acre is perhaps higher than in any section so large as this in California. There have been shipped from Kings County this season 150 carloads of green fruit and 100 carloads of dried—mostly peaches and apricots.

#### INSECT PESTS.

Insect pests, except codlin moth and yellow mite, have done but little damage to our trees, vines, or fruit this season. The brown-necked scymnus and the lace-winged fly have almost destroyed the San José

scale. The twig borer, strawberry root borer, or peach worm—all of which are names for the *Anarsia lineatella*—has done some damage to peaches by boring into the stem of the peach and rendering them unfit for shipment. Arsenic compound sprays have saved the pears, but a large portion of the apple crop was lost by the codlin moth. The yellow mite has done the prune orchards great damage this season, stripping the trees of their foliage in July and August, thereby exposing the fruit to the sun and checking the growth of the young trees. They feed upon the forest trees, and indeed upon almost everything, and threaten to be a great nuisance. No remedy has been more effectual than a spray of cold water applied to the under part of the leaf with force enough to break the web. The State Board of Horticulture could not do a better work than to have this insect studied, and its parasite, if it has any, and bring out, if possible, something to destroy it. The difficulties in the way are the habits of the insect. It does not eat the leaf, but feeds upon the juice of the plant, therefore you cannot poison it. If I am not mistaken in my observations, it does not lay its eggs like many other insects, but they are hatched in the body of the dead mother, and are protected by the web while young.

#### TULARE COUNTY.

Tulare County has kept pace with her sister counties in the San Joaquin Valley, and the past season has witnessed very large areas of new land set to orchard. The division of the county and the setting aside of a large part of the new county of Kings has, of course, reduced its orchard area very largely, as the portions removed included some of the finest and most densely planted orchard lands in the county. The principal fruit sections in Tulare County are now Tulare, Traver, Visalia, Farmington, Orosi, Porterville, Plano, Lindsay, and their immediate surroundings. In this district there has been no loss of faith in the future of fruit growing, and very large quantities of both deciduous and citrus fruits have been planted in the past year. Prunes have been the favorite, the large yield and excellent curing qualities of this fruit giving an incentive to its planting. This has been seconded by the early age at which the trees come into bearing. The uniformly cloudless and hot weather during the drying season are also great inducements in the way of prune culture, and the growers of Tulare County assert that they have there perfect conditions in soil and climate for the fruit. Peaches do equally well and the crop of the present season has been exceptionally large. A very large part of this crop has been cured and is still in the hands of the producers.

Much attention is being directed to olives in different parts of Tulare County, especially in the foothill regions, and this fruit does exceptionally well. In a few years Tulare will add her annual quota of olive oil to the product of the State, and aid in making what is now a respectable industry an important one.

Considerable experimental work has been done with figs, and while some very fine samples of figs have been packed, many of our growers have to contend with the fungous growth in the Adriatic fig, which causes the young to sour. When we discover a remedy for this trouble another very important fruit industry will be inaugurated in Tulare.

The extension of her irrigation systems and the vast abundance of

water for irrigation purposes supplied by the perennial streams from the Sierra Nevada Mountains, make Tulare one of the most fertile counties of our State. For many years her extensive plains were used only for the production of the cereals, but with the introduction of water wider and wider areas were set to orchard, until to-day she takes her place in the front rank of the fruit-producing counties of California; and in the wide range of her productions, which cover all, from the hardy apple of the northern clime to the tender lime and pineapple of the tropics, she cannot be excelled by any county in the State.

#### MERCED COUNTY.

Merced County has made rapid strides in horticultural pursuits in the past few years, encouraged by the construction of the Crocker-Huffman canal, which made a large section of excellent fruit land available for cultivation. Since the date of my last report there have been many new orchards planted here, and many of those formerly planted have come into bearing, until to-day Merced takes her stand among the principal fruit-producing counties of California. This county presents a very wide range of soils, including the rich alluvium of the bottoms; heavy red adobe, free from and mixed with gravel; loam containing sand and gravel; and a very sandy loam. With such variety of soil, its climate, and an abundant water supply, Merced is rapidly coming to the fore in the production of a very wide range of fruits, both citrus and deciduous. The yield of peaches and apricots is reported as more than usually large this season, and the fruit was very fine. At the Rotterdam Colony the canning company put up a large quantity of canned fruit for the Eastern market, and a much larger quantity was dried.

Raisin growing is the principal horticultural industry of Merced, and a very large area of new land has been set to vineyards during the present year. The crop this season is reported as very large. Large shipments of fresh grapes were made to Chicago during the season, but the greater part of the grape crop was dried. Much attention is being directed to citrus fruits here, and in many localities the lemon has been found to do well, while the orange flourishes over a large part of the county. West of Merced City are several orange groves, which look as healthy and produce as fine fruit as any I have seen in the State. A correspondent writes me in regard to the olive in Merced:

"The olive is the pride of our horticulturists. Next year there will be planted thousands of acres in addition to the many hundreds of acres of trees now loaded with this noble fruit. There is no soil or climate upon the earth better adapted to the growth of the olive than that of Merced County. The fruit covers the whole tree, and the present crop, which is flatteringly promising, will be gathered about the first of December. At the late district fair held in Merced, M. D. Atwater had an exhibition of several bottles of olive oil as fine as any ever imported from Europe.

"Most noticeable among the products of this county, not indigenous to the soil, is the rapid growth and variety of nuts. Many of our farmers are meeting with complete success in the cultivation of English walnuts, almonds, black walnuts, peanuts, and chestnuts. Among the varieties of chestnuts the Italian is the favorite. It is more than twice the size of the American chestnut, and of a much richer flavor.

"The Buhach Company is now largely engaged in horticultural indus-



tries, and is fast becoming noted for its production of fine fruits. The colonies north, south, and west of the city are being rapidly peopled with well-to-do families from the East and from different parts of Europe, and horticulture in all its branches is in a healthy and progressive condition. Water from the Crocker and West Side canals is attainable at all seasons of the year, in quantities to meet the most extravagant demands. There will be a large quantity of canned, dried, and ripe fruit sent to the Midwinter Fair, which will doubtless compare favorably with the fruits from any other county on the coast."

#### STANISLAUS COUNTY.

Very marked improvement has been made in Stanislaus County from a horticultural standpoint during the past season, and here, as in the other counties of my district, numbers of new orchards have been put out. Not so much attention has been paid to fruit as to wheat in this county in the past, but the low prices of cereals of late have had the effect of turning more attention to fruit growing. In the foothills of Stanislaus County some very fine oranges are grown, and much attention is now being paid to citrus fruits. In the higher portions of the county, too, some remarkably fine apples are produced, while in the lower portions peaches, prunes, and pears do well. Raisins have been tried to some extent and have done well.

#### KERN COUNTY.

In Kern County considerable new planting has been done in the past season, largely in peaches, prunes, apricots, and raisins. Some very choice fruit has been produced here, that from the orchard of C. A. Maul, near Bakersfield, having won general admiration at the Chicago Fair.

#### SAN JOAQUIN COUNTY.

In San Joaquin County great activity has been shown during the past season, especially in the vicinity of Lodi, which is rapidly becoming the heart of the fruit section of this county. San Joaquin is favorably situated in having water communication with San Francisco, and in being a terminal point on the railroad, and hence has the advantage of easy and cheap transportation to market. Very large quantities of fruit from this county have been shipped both to San Francisco and the East, and fair prices generally have been realized during the season.



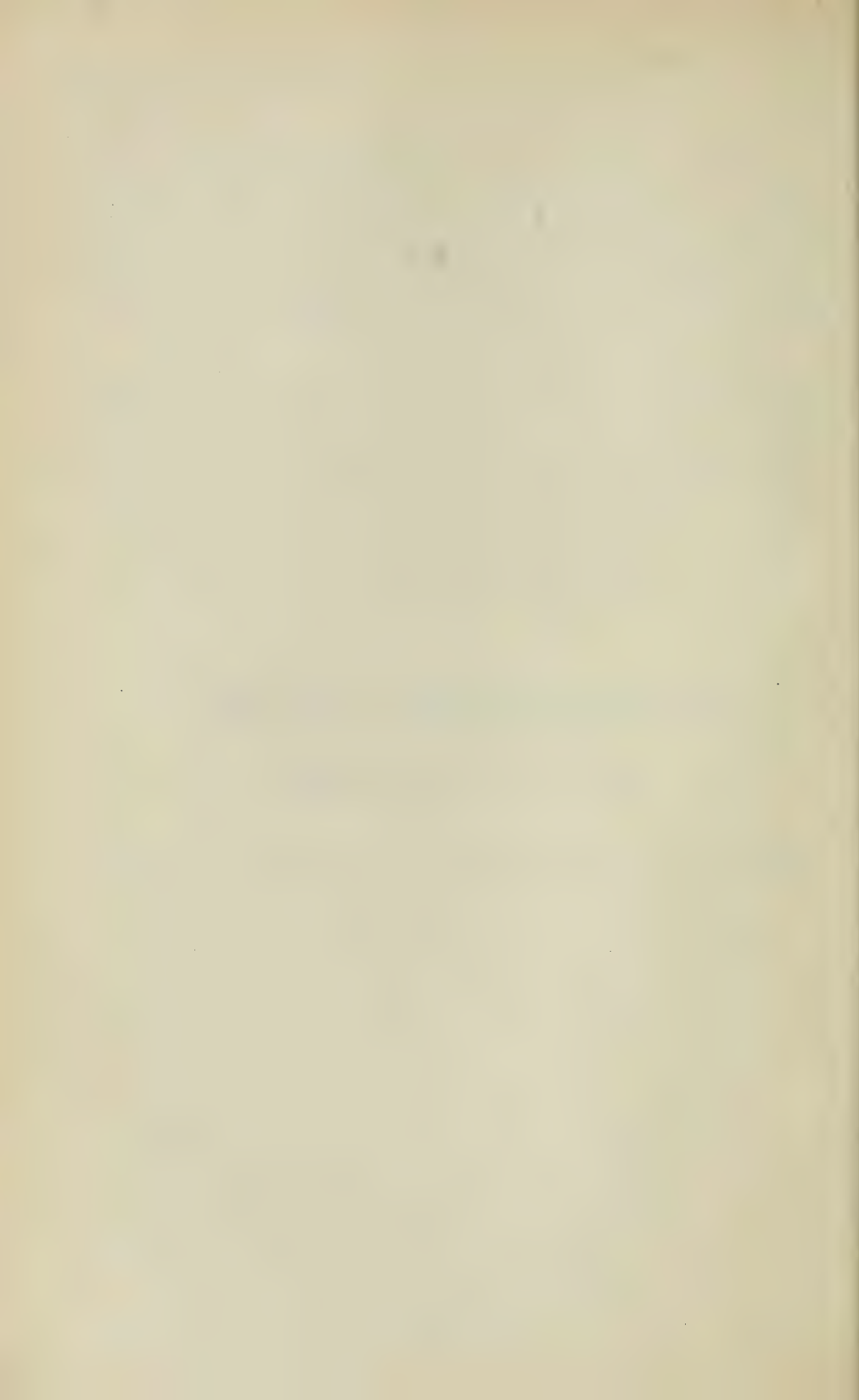
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REPORT  
OF  
ALEXANDER CRAW,

Quarantine Officer and Entomologist.

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## VII.

# ENTOMOLOGY AND QUARANTINE.

By ALEXANDER CRAW, Quarantine Officer and Entomologist.

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*To the honorable the State Board of Horticulture:*

GENTLEMEN: Since my last report forty-nine steamers and sailing vessels have arrived in the port of San Francisco from foreign countries, having on their manifest, or in the possession of passengers or crew, plants or trees that required inspection. As this covers the summer season, the fact that 153 cases and boxes were received, would indicate that the demand for something new still continues, notwithstanding the heavy loss to several importers within the past few years, who had pest-infested or diseased trees or plants. However, a very decided improvement has been noticeable in their freedom from insects. This would indicate a more wholesome regard for the laws and regulations governing the same. Most of the stock received during the summer are ornamental trees and plants. The season for fruit trees is from the end of November until the middle of April. The countries from which the above vessels arrived are China, Japan, Mexico, Central America, Australia, New Zealand, and Hawaii. The great bulk of the plants came from Japan. The Japanese are noted for their quaint flowers, dwarfed trees, and shrubs, and lovers of plants visiting that country generally bring a collection on their return. This is a source of great danger, as such people know nothing about our laws and use no care in selecting healthy plants.

Besides frequently finding the insects referred to in former reports, the following kinds were found and destroyed: On Sunday, June 18th, the steamship "City of Peking" arrived from Japan, having on board a case of plants from Singapore, India, four of which were cinnamon trees, infested with a dark gray wax-scale of the genus *Ceroplastis*, one eighth of an inch long and nearly as wide. They have a raised, convex body, with a small brown spot in the center, and two white oblique lines on each side of the scale. They differ greatly in color and size from the *Ceroplastis* frequently found on Japanese plants.

On June 26th, the steamship "China" arrived from Japan, and had six pot-grown cherry trees that were infested with a bluish-gray aphid. They were so numerous that the young wood for its entire length was completely covered. The leaves were free from them, but covered with honey-dew and fungus. I believe this would be a serious drawback to cherry growing if they obtained a foothold in California. The trees were dropped overboard. On the same steamer I found a deciduous magnolia infested with black scale (*Lecanium oleæ*). I mention this to show the existence of this pest in that country, although I do not think it has a very wide distribution there, or I would more frequently find it.

On June 28th I found five oleanders on the steamship "Australia,"

from Honolulu, infested with a small circular, spiny scale, probably an *Aspidiotus*, but the rough spiny dorsal scale is something new. The effect upon the wood of the oleander from the attacks of this scale is the opposite to that produced by the "mining scale" (*Chionaspis biclavis*), which was found on the Tahiti orange trees that were condemned and destroyed over two years ago. In this case the wood appears to be poisoned immediately surrounding the scale, and does not expand as rapidly as the part not attacked, thus causing a depression instead of a swelling, as in the case of the "mining scale." These plants were burned.

Another scale from Japan was found on camellias that arrived on August 2d on the "Rio de Janeiro." This was rather a pretty, small, white insect, infesting the leaves and wood, and resembles a *Ctenochiton*. The plants were thrown overboard. On the same plants I found a number of tortrix larvæ that were devouring the leaves. On an invoice of Japanese pine trees I found several lepidopterous larvæ that had rolled up the leaves and destroyed the tips and terminal twigs.

On August 4th the steamship "Monowai" arrived from Australia with a case of plants for the Department of Agriculture, Washington, D. C. In the case were several orange trees slightly infested with "red scale" (*Aspidiotus aurantii*). The trees and plants were very much shriveled by drought. I watered them and wrote to Secretary Morton of the existence of the red scale on the orange trees.

On the same steamer there arrived a more conspicuous enemy of the orchardist than the harmless appearing scale bug. This was a "flying fox" (*Pteropus rubricollis*), that was making a breakfast on a banana and a ripe pear. It was driven out to sea and took refuge in the rigging of the steamer soon after leaving Australia, and, after an exciting chase, was captured by one of the passengers, who brought it along as a pet, and who was very much annoyed when I informed him that I would not allow it to be taken ashore alive. I procured an ounce of chloroform and a sponge. After tying the latter to a stick I saturated it with chloroform and applied it to the nostrils of the fox. She soon dropped to the bottom of the cage, where I placed the sponge to its nose and left it for one hour. The body of this specimen was 14 inches, with a wing spread of 3 feet 2 inches. Next to the rabbit, the flying fox is considered the most serious pest in Australia.

The July (1890) number of the "Agricultural Gazette," of New South Wales, contains a very interesting account of experiments that were conducted—under the orders of the Ministers of Mines and Agriculture—in destroying flying foxes by means of dynamite and other explosives. In order to show the possible danger from the introduction into the State of such a pest, I will give a few extracts from the "Gazette":

The Minister has long recognized the extent of the depredations committed by these animals, and also the difficulty of coping effectively with them. The damage done every year to the orchards in the coast district must be estimated at many thousands of pounds. The haunts are numerous, and contain millions of foxes, which sally out night after night to pick the choicest morsels of the choicest fruit in the orchards, within a radius of 20 miles of the respective haunts.

The Minister having received urgent requests for help from thirty different fruit-growing districts, determined to assist any parties organized to attack the animals in their haunts, by supplying the ammunition. The result was a considerable expenditure of powder and shot, and a destruction of perhaps one hundred thousand foxes, at an average cost of £1 for one hundred and fifty. It was soon seen, however, that spasmodic attacks in isolated districts would not sensibly diminish the pests, but merely split up large camps into small ones. It must be attacked in a systematic and wholesale manner. The reports of fifteen hundred killed in one tree by the explosion of one pound of dynamite was very alluring and experiments were ordered.



An interesting account of the experiments is then given, but the unanimous opinion of those who witnessed the experiments was that the destruction of flying foxes on a large scale by explosives is impracticable. The foxes spend the day in oak and other trees that afford shade. The absence of such trees in the immediate vicinity of an orchard is no guarantee of immunity from their depredations, as they are known to fly over twenty miles during a night. Various devices are used to protect the fruit; some use wire netting, and others stretched wire attached to poles over their trees, which cuts the membranous wings of these animals, causing them to fall and they can then be destroyed. They are especially fond of peaches, but all soft fruit is eaten by them.

On October 10th four more flying foxes arrived on the steamship "Rio de Janeiro" from China, and were destroyed.

On August 15th the steamship "Gaelic" arrived, and an ornamental plant in the possession of a passenger was found infested with *Rhizzicoccus*, new to the State, and was destroyed.

On September 15th the steamer "Newbern" arrived from Mexican ports, and had on board 1,157 boxes of oranges from San José del Cabo, that were infested with the "long scale" (*Mytilaspis gloverii*). I immediately served quarantine papers on the importers, and also notified the steamship company not to deliver said oranges until the law had been complied with. The importers refused to disinfect or fumigate the fruit and abandoned it to the Government, after having paid the freight. After nine days it was sold by the United States customs officials, for duty, and bought in by L. G. Sresovich & Co., of San Francisco. Just before the sale took place the people in attendance were informed that whoever bought the fruit would be required to disinfect it before it was delivered. After the sale the fruit was again quarantined. As the dock is roofed it gave the necessary shade, and the work of fumigating was done in the daytime. Six days were required to do the work. An airtight canvas was spread over the dock floor, to prevent the gas from escaping. On the top of this were placed 2x4-inch scantlings 16 feet long; on these were placed 4x4-foot wire trays holding one layer of oranges; more scantlings and other layers of trays were placed, until they were 11 high, making a stack of 180 cubic feet. Over this was spread an oiled canvas, and at each end under the canvas was placed an earthenware vessel, into each of which was put two ounces of 60 per cent fused cyanide of potassium, four fluid ounces of water, and lastly two fluid ounces of sulphuric acid. This was double the amount generally used for the treatment of scale-infested trees in the orchard. The fruit was subjected to the gas for forty-five minutes. Four men did the work and operated upon three stacks of fruit without loss of time. When the oranges were spread on the trays all infested oranges were rejected; in this way 110 boxes were destroyed.

On September 28th the steamship "Colima" arrived from Central American ports. One of the passengers had a box of yellow guavas that were infested with lepidopterous larvæ. They work in the same way that the codlin moth attacks the apple and pear. The worm is nearly as large as the codlin moth larva, but darker, and some of the guavas contained two specimens. There is a possibility that this pest would also attack the strawberry guava that has been extensively planted in the southern counties, so the fruit was destroyed.

On October 24th the steamship "Gaelic" arrived from Japan and had

on board one hundred and fifty two-year-old plum trees that were very badly infested with a brown *Chionaspis* that extended down the stem below the surface roots. Specimens of those trees were treated and preserved; the balance were burned.

On the same steamer were one hundred one-year-old pear trees, infested with a borer. This is undoubtedly the larva of a beetle. It is a small, white, cylindrical worm, and measures one third of an inch in length. In its operations it eats an irregular patch of the bark, from one half to one inch long and one quarter of an inch wide; sometimes this is vertical, and in others it has extended around the tree; it then enters the wood and tunnels upwards for an inch and a half, killing the twig above the point of entry. The trees were burned, but specimens of the borer and their work were saved.

#### BENEFICIAL INSECTS.

As per instructions, I visited in August last Santa Barbara, Los Angeles, and Orange Counties to examine into the condition of the last importations of Australian ladybirds. The first place visited was the olive orchards of Hon. Ellwood Cooper, at Ellwood. The first orchard examined was a disappointment, but it afterwards proved to be an object-lesson of value. Here the black scale was very plentiful and the ladybirds scarce. Mr. Cooper's explanation of this is undoubtedly correct. At the time the "black ladybirds" (*Rhizobius ventralis*) arrived (in the spring of 1892), Mr. Cooper's men were spraying this orchard with kerosene emulsion, and he directed the men to reserve forty-nine trees in the center of the orchard, where he placed a colony of *Rhizobius*. Those forty-nine trees are comparatively free from young scales and black fungus. The ladybirds were undoubtedly prevented from working on the sprayed trees by reason of the odor. They are now spreading through the orchard, and I look for good results.

The next orchard visited (the central one), where no spraying had been done, and in which no ladybirds had been placed, was indeed encouraging. This orchard is separated from another—where a colony was placed—by a gully filled with oak trees. Here the *Rhizobius* were very numerous, and their good work was evident.

The next orchard—the one where the original colony was liberated—is the evidence that makes Mr. Cooper so confident that the black scale can be conquered. In this orchard the old black scales were as plentiful on the twigs as they are in the other orchards visited, but the young that hatched during the summer have been destroyed by the *Rhizobius*, and the trees are free from honey-dew. I visited this orchard one month later, and found that the *Rhizobius* had migrated to trees that furnished more food. I still found some larvæ, but it was evidently a hard struggle with them for existence. Mr. Cooper had removed a colony to another orchard, where food is abundant, about four weeks before my last visit to his place, and upon examining the tree where he placed them I found larvæ two-thirds grown.

At Mr. Cooper's I found beetles and larvæ of the steel-blue ladybird (*Orcus chalybeus*), but not in such numbers as would give any hope that they will do any good against the black scale. When Mr. Koebele sent this species he stated that it was for the "red scale" (*Aspidiotus aurantii*), so we are not disappointed.

The large blue, six-spotted ladybird (*Orcus australasia*) is a more general feeder, and I think in time will be an effective help in keeping down the different scale pests. It appears to love the sunshine, and was more plentiful on the outer row of the orchard and on the top branches of other trees.

*Rhizobius debilis* is also increasing. This is a smaller beetle than *R. ventralis*, and feeds on the "pernicious" scale as well as the "black."

I next visited Mr. L. N. Kercheval's orchard in Los Angeles, where the steel-blue ladybird was placed. The State Board had received very encouraging reports in regard to this colony. A well-known fruit grower made the discovery last July that this ladybird was steadily increasing in spite of the condemnatory reports that had been circulated about it in the spring, and reported the facts to the papers. A number of the fruit growers then visited the orchard, and afterwards petitioned the County Supervisors to appoint a guardian. The appointments made were not satisfactory, and the State Board was requested to take charge of them. I was then instructed by the Secretary to see what could be done. I secured the following authority from the owner:

RIALTO, August 28, 1893.

Mr. Alexander Crow is hereby authorized by me to take charge of the *Orcus chalybeus* on my place in Los Angeles, in the interest of the State Board of Horticulture.

LELAND N. KERCHEVAL.

I was instructed to employ Mr. John Aerni, the lessee of the orchard, to guard them at a monthly salary of \$40. I was also instructed to distribute the ladybirds, if in my judgment it was deemed advisable. After looking carefully over the orchard, and noting the fact that, as far as I could see, food in the upper or northern portion of the orchard was plentiful, I so reported to Mr. Cooper, and under his advice, only three colonies of one hundred each were distributed. One colony was sent to San Gabriel Valley, one to Orange County, and the other to Santa Barbara County. While the increase of this species was very good, we deemed it best to let them remain this winter. They have certainly increased more rapidly than any species of our native *Coccinellidæ*, and I still consider it a valuable insect.

I next visited Orange, but could find no trace of the colony sent there, nor at Tustin. One of the places where we found beetles and eggs in the fall of 1892 had been sprayed, as nothing could be seen of them in April, 1893—about that time the Los Angeles colony was reported a failure.

My instructions were to return to Ellwood on September 23d, to assist in the distribution of the black ladybird (*Rhizobius ventralis*), but I was detained in San Francisco until the 30th, on account of quarantine duties. Mr. Cooper thought that all the applications would be in by that time (September 23d), and we could fill them all on my visit. In this he was agreeably mistaken, for after sending out 453 colonies—of twenty-five to fifty ladybirds in each—we have since received applications for nearly 500 more colonies. These will be sent out in May or June. This I consider preferable to sending them during the rainy season, although the larvæ could be found last January. Each colony was sent in a small, flat wooden box, with sliding cover, and strong enough to resist the pressure in the mail sacks. In each box was placed a little damp sphagnum moss that supplied the necessary humidity in such a small, close space. The moss also prevented injury to the beetles



in the handling of the mail sacks. The majority of the applications came from the southern and central coast counties. The value of this ladybird can hardly be estimated, and establishes the wisdom of the State Board's policy and efforts in behalf of the fruit growers. It also adds additional luster to Professor Koebele's name.

#### INJURIOUS INSECTS.

When in the southern counties, I visited, as far as possible, the different Horticultural Commissioners and discussed with them matters relating to their work. In Santa Barbara County the Supervisors are pursuing a very unwise course in regard to their horticultural officers. The latter are certainly to be thanked for the amount of interest and work performed by them for the benefit of the fruit growers and the county at the small compensation allowed them.

Ventura County has an active Board and local inspectors. Here the Supervisors are more liberal and the result is a county free from the more destructive fruit pests. Occasionally a patch of "red" and other serious scales have been found, but by vigorous work they have been stamped out and the county fruit interests protected.

It was reported to the Los Angeles County Supervisors in August, that certain orange groves in the Downey and Rivera districts were seriously infested with "purple scale" (*Mytilaspis citricola*). Commissioner John Scott was instructed to look into the matter and have the scale exterminated. He invited me to accompany him, which I did, spending two days in that section. This investigation revealed the fact that this most destructive citrus tree pest is very widely distributed over that valley. The trees on which the pest was introduced were Florida-grown and planted four years ago. The scale has spread into some large seedling trees. I advised that a thorough tree to tree examination be made, and all infested trees be cut back to the large branches or stump and well scrubbed with soap or rosin solution, and the adjoining trees be fumigated with hydrocyanic acid gas.

In the bay district at San Diego, I found considerable of this purple scale on Florida-grown trees, that had been allowed to spread. A new Commission was appointed last May, and they have taken hold of the insect question in a vigorous manner and are determined to stamp this and other pests out. The fruit growers, Supervisors, and the press of the county are assisting and encouraging them in their good work.

Such a pest as the "purple scale" would be a serious menace to San Diego's bay district becoming the leading lemon section of the State. Its natural advantages and the already extensive plantations of this fruit justify the most stringent measures to stamp out this pest.

The Commissioners of Orange County have to do their own inspecting and quarantine work, and appear to have the confidence of their citizens. This county was unfortunate in having the red scale in a number of its groves before any effective means of fighting it were known. With spraying and fumigating, the orchards are much improved within the past year. The cottony cushion scale got a start last year, but the Commissioners placed a colony of *Vedalia cardinalis* in the infected orchard, that thoroughly cleaned the scale out.

San Bernardino County Commissioners are also well supported by their Supervisors. No new pests are reported by them, although the

black scale has spread throughout that locality—a section that heretofore has been considered unsuitable for the increase of this scale. The increased shade and new acreage of trees planted, with its accompanying humidity, probably account for this.

Riverside County is peculiarly fortunate in having probably 90 per cent of its citizens directly interested in her orchards and vineyards. On this account the Horticultural Board is well supported. The Commissioners show good judgment in the selection of their local inspectors; they are young, active men, and their work speaks volumes of praise. In this county anything in the shape of a scale insect is vigorously fought. However, I think that they could save the heavy expense of fumigation in any orchard where the cottony cushion scale is found, as this scale can now be successfully suppressed by the *Vedalia*.

In Alameda County I found some larvæ infesting ripe cherries that, when bred, proved to be the codlin moth (*Carpocapsa pomonella*). This, I think, is a new food for this pest, but they were not found in any great numbers.

#### PARASITES.

In the spring of 1891, a bulletin was issued by your directions, calling attention to a parasite (*Coccophagus citrinus*) found attacking the "yellow scale" infesting citrus trees in the San Gabriel Valley. This bulletin met with considerable adverse criticism from certain parties, who pronounced its recommendations as premature, but I am pleased to report that on my recent inspection of the central portion of the valley, where the scale was the most abundant at that time, it was found to be now practically free from "yellow scale." In the Downey section, where this scale has got a strong foothold in several orchards, it is on the increase and the current year's growth and fruit are badly marked. Here I saw no trace of the parasite. An effort should be made to introduce them. Several orchards south of Los Angeles that were formerly infested with this scale have also been restored by this chalcid fly.

Early in October my attention was called to the fact that the "red scale" (*Aspidiotus aurantii*) was decreasing in the orange and lemon groves south of Los Angeles, but I was inclined to believe that it was only the natural result of such insects after reproducing their kind. But an examination of the infested branches, and leaves, and fruit, soon convinced me that something more than old age was the cause of the great mortality, for small and half-grown scales were numbered among the dead. Specimens were numerous where the disease was in the incipient stages. This was indicated by a chocolate blotch or discoloration of the insect; sometimes this would appear on the abdominal segments, and on others the body of the scale would have from one to four shrunken brown spots. When in an advanced stage of the disease, some of the specimens placed under the microscope showed unmistakable signs of a fungous growth. Whether this fungus is an after result of the disease or is the primary cause of the great death rate, cannot be determined unless by cultural experiments with the fungus in new groves. In some specimens the ventral scale is covered with this fungus, and in others the body of the scale; in the latter case the scale is forced up and the wind or shaking of the branches removes it, leaving a white spot, indicating where the scale has been.

The orchards visited were Mr. George Dalton's and Mr. McDonald's,

on Washington Street, and Mr. L. N. Kercheval's on Lemon Street. At the latter place the disease was more noticeable, and this would lead us to hope that it is one of the fungi sent over by Professor Koebele on his last mission to Australia. This will be watched, and, if necessary, steps will be taken to disseminate the disease or fungus to other sections that are troubled with red scale.

#### ATTELABIAN SNOOT BEETLE.

*Rynchites bicolor*, Fab.

A small, dark red beetle, with deep blue-black head, snout, and legs. It measures fully one fourth of an inch. The wing-covers are nearly square and finely punctured in rows. They are frequently found on ripe blackberries and raspberries, puncturing the fruit with their beaks, causing it to decay. In portions of Europe this beetle is very destructive to grapevines.

The different kinds of *Attelabus* roll up the edges of the leaves, forming little nests the size and shape of thimbles, to contain their eggs and shelter their young, which afterwards devour the leaves.

This beetle is also found on oak leaves in early summer.

*Remedies.*—This insect has not been reported in sufficient numbers to be considered a pest, so simply jarring the canes will cause them to drop to the ground, where they can be destroyed. If found on other than bearing berry canes they can be killed with Paris green—one pound to two hundred gallons of water. Keep the solution constantly stirred, and apply with a force pump and fine spray nozzle.

#### BEAN WEEVIL.

*Bruchus obtectus*, Say. *Bruchus fabæ*, Riley.

As this destructive little beetle has been reported from one of the principal bean-growing counties of the State, a short account of its life history, also a successful method of destroying it, will be of interest.



Bean Weevil,  
very much enlarged.

The perfect beetle measures a little over one eighth of an inch in length; the head, thorax, and wing-covers are dark grayish-brown, the latter being faintly striped longitudinally. The extremity of the abdomen protrudes beyond the elytra, and is covered with short brown hairs. The snout and head are somewhat bent under the thorax, giving the insect a chubby appearance. The abdomen, legs, and tips of the antennæ are obscure, rufous. The female deposits her eggs on the pod, and soon after hatching, the larva burrows into the pod and enters the bean; from one to over a dozen have been found in a single seed, which they devour, leaving very little but the skin. The larva when full grown gnaws to the edge, where it changes to the pupa inside the bean, from which it makes its escape in the perfect state.

Beans that have been or are still infested can be readily detected by the hole where the beetle escaped or by the circular dark spot on the skin under which the larva or beetle is located. Such beans should not



be taken into a section that is free from the weevil, and too much care cannot be taken in purchasing clean seed.

*Remedies.*—Dipping the beans in hot water for one minute has been recommended as a sure cure for this pest, and after experimenting in this line I am satisfied as to its efficacy in killing the weevil, but it also killed the germ of the bean, for even those beans that were not attacked by the weevil failed to grow. I then made several experiments with bi-sulphide of carbon, and found it to be very effective in destroying all insect life, and from its powerful solvent properties it also killed the weevils in the pupa state inside the beans. When I found that this was effective, I tested the seed with double the amount of bi-sulphide, in order to see the effect upon the germ. This was equally satisfactory, for all the beans that had not been too much punctured germinated.

As an expeditious way of treating the beans I would suggest the use of large air-tight boxes with hoppers on the top and chutes at the bottom, through which the beans can be quickly withdrawn into sacks after having been disinfected. To each one hundred cubic feet I would use one pound of the bi-sulphide of carbon. Pour the liquid into a shallow earthenware vessel placed on the top of the beans. As the bi-sulphide is very volatile and its specific gravity is greater than the air, the gas or vapor settles to the bottom of the box, filling it and displacing the air. The box should remain closed for four hours. This work should be done in the open air or in an open shed. The workmen must stand to the windward and be careful not to inhale the fumes. Bi-sulphide of carbon is highly explosive, so no lights or smoking should be allowed in the vicinity. The beans intended for seed or holding over should be treated in the fall. All straw and rubbish should be raked up and burned soon after thrashing, so as to destroy any pupæ, or material in which the beetles could hibernate.

#### BLACK THRIP.

##### *Thrips.*

A minute, narrow, black, six-legged insect, with four narrow, transparent wings bordered with light silvery hairs.

This is an old and well-known pest of hothouse plants. Occasionally it is found on laurestines, fuchsias, and other outdoor ornamental trees or shrubs in this State, but I can find no record of it as a pest on citrus trees. The past winter, however, I received specimens of oranges and orange leaves from San Diego County that were completely covered with light-colored young and fully developed black insects, together with the small, dark blotches that indicate the presence of this pest. The fruit had changed to a dull gray color that would ruin its commercial value. The leaves were also affected in a similar manner. This discoloration was caused by the bite of the thrips, for although they are classed with the order Hemiptera, they are provided with bristle-like mandibles, with which they tear the epidermis of the leaf or fruit. A careful examination of orange blossoms and other sweet-smelling flowers will reveal the presence of delicate, but very active, yellowish insects. These are *Thrips tritici*, and will give an idea of the appearance of the other, except in color. But the black thrips are slightly larger and more sluggish in their movements.

*Remedies.*—Trees or plants infested with thrips can be disinfected by spraying or dipping in a warm solution of whale-oil soap—one fourth to one half a pound of soap to each gallon of water, according to the hardness of the plant. Several importations of *Araucaria excelsa*, from Australia, have been found infested with black thrips, and were successfully disinfected by fumigation with hydrocyanic acid gas; but the density of the gas should be slightly less for araucarias than is recommended for citrus trees, or it is liable to injure the foliage.

For the San Diego orange trees I recommended that they be fumigated with hydrocyanic acid gas, in the proportion of one ounce of cyanide of potassium (60 per cent), one fluid ounce of sulphuric acid, and two fluid ounces of water to each one hundred cubic feet of space inclosed by tent, and prepared as directed for red scale. This was done by the County Horticultural Commissioner and was entirely successful.

#### PEACH TWIG BORER, OR STRAWBERRY CROWN BORER.

*Anarsia lineatella*, Zeller.

This is a very small, dark gray moth, with darker spots and streaks on the forewings. The larva, or caterpillar, when full grown, is nearly half an inch long, and varies in color from dark brown to brownish pink in the different stages.

This pest is found in nearly all the peach districts of the State, and in some seasons the borers are so numerous that they destroy all the young growth in the center of the tree. There has been considerable mystery about the life history of this moth, but Mr. E. M. Ehrhorn, of Mountain View, Santa Clara County, has cleared up a portion thereof that will assist in our successfully fighting them. It is Mr. Ehrhorn's opinion that the female moth deposits her eggs in the crotch of the branches or between the rough bark in the fall of the year. In support of this theory he called my attention the past winter to the very small borers at work in the spongy bark; here they grow slowly until the tree produces new growth, when they leave the bark and burrow into the tips of the new shoots, which soon wilt and dry up. Frequently the larvæ are nearly full grown when they attack the young growth. This accounts for the fact that upon old trees the under and inside twigs suffer the most from their attacks, whereas the top and outside branches escape.

Besides the peach it also attacks the almond, nectarine, apricot, and prune.

*Remedies.*—The trees should be sprayed in January or February with coal oil emulsion or rosin solution, or the lime, sulphur, and salt mixture. These washes will penetrate the burrows and destroy a large percentage of the small larvæ. When the trees have started to grow all the wilted shoots—indicating the presence of borers—should be clipped off and burned. The later brood attack the fruit near the stem. When the larvæ are full grown they change to small brown chrysalis, generally among the dry leaves formed by the death of the tender twig, or under the rough bark.

In the Eastern States this pest is subject to the attacks of parasites. An effort will be made to introduce them the coming summer.

## CUT WORM.

*Agrotis atomaris*, Smith.

This pest has been a source of annoyance and serious loss this season in several fruit-growing sections of the great San Joaquin Valley, especially on grapevines and prune trees. They burrow into the loose soil from two to three inches under the surface, where they remain during the day, and at night they ascend the vines and trees,



Larva, natural size.

where they feed upon the tender leaves, and if not checked will seriously injure or kill the trees. They make their appearance in April, and by the middle of May they have completed their growth and measure about one inch and a half in length, of a light gray color, smooth and naked. At this stage they burrow deeper and form an oval hollow, where they change into a brown chrysalis preparatory to coming out as a moth.

*Remedies.*—The only satisfactory way to combat this pest is to place a band of stout paper around the stem of the vine or tree and smear it with printer's ink, in which a little castor oil has been mixed to prevent it drying too quickly. See that the band is kept moist by repeated applications of the ink; about two or three times a week will be sufficient to prevent them climbing. Commissioner Berry, of Tulare County, recommends placing a piece of smooth cardboard around the stem; cut in such a way that it stands at right angle from the tree and with the glazed side downward, it makes a perfect barrier to the worms. George T. Hughes, of Modesto, saved his trees by having his men commence in the morning as soon as they could see, and by jarring the trees slightly brought the worms to the ground, where they were destroyed.



Moth, natural size.

## SPHINX MOTH.

*Philampelus achemon*, Drury.

Several vineyards in Fresno County were seriously injured by the caterpillar of this moth during May and the first week of June. The moth is large and handsome, with narrow sinewy wings, indicating great power of flight. When expanded they measure nearly four inches from tip to tip. The fore wings are a grayish-brown, with three dark blotches upon each. The hind wings are a beautiful rose color with a light brown border, through which run a line of small dark blotches. The moth is very active on the wing and can be seen after sundown darting about depositing her eggs on the grape leaves. The eggs are round, pale green, and attached to the leaf by a gummy substance.

In the first stages the larvæ are light green, with a long, dark brown anal hair or horn; they change to a reddish brown as they grow older. The horn finally disappears, leaving a small cream colored tubercle with a black central spot. The full-grown larva is speckled over the back



and sides; the back is brown, with a light band along each side. Under this the body is dark brown with six to eight creamy white, oblique bars. I raised larvæ from the egg to the chrysalis this season, in confinement, in twenty-nine days. When about to change to the chrysalis they descend from the vine and burrow into the soil a few inches, where they remain until the following spring, when they come forth as winged moths.

*Remedies.*—The most effective way to check this pest is to hand pick, or clip the worms in two with a pair of scissors. As this can be done in the daytime, very thorough work can be accomplished. In the winter the ground should be gone over several times with a disk harrow after plowing, so as to destroy the chrysalis.

Fourteen years ago this worm did considerable damage to the young raisin vineyards in a portion of what is now Orange County. They have also appeared in other parts of the State in different seasons and have been cleaned out by hand picking.

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## VIII.

### SCALE INSECTS.

#### AN ELM SCALE.

*Gossyparia ulmi*, Geoffroy.



Natural size.



Female, enlarged.

The young elm trees in the grounds of the Leland Stanford, Jr., University, at Palo Alto, were noticed by Quarantine Guardian Ed. M.

Ehrhorn the past season to be seriously infested with this injurious scale. The scales in the adult stages locate on the under side of the twigs and branches, and the bark is thickly covered with an unsightly black fungus that soon destroys the vigor and beauty of this popular shade tree. The trees have been planted several years, and are now fifteen to twenty feet high. I have been unable to trace the introduction of this scale, but as this is the only place that I know of in the State where it has secured a foothold, it was undoubtedly brought here upon the trees from an Eastern nursery. It is a common pest of the elm in portions of Europe, and has within the past six or seven years been noted in several of the Atlantic States.

Mr. Howard gives the following description of this scale in the August (1889) number of *Insect Life*, taken from M. Signoret's article in the *Annales de la Societe Entomologique de France*, for 1875, with a fuller description of the adult male:

The newly hatched larva is of an elongated oval form, narrower behind, of a clear yellow color, each segment with a strong lateral spine, and the front border of the body with six spines. The genito-anal ring has six hairs, around which is later formed a secretion, which renders them invisible. There is a double row of spines down the middle of the back; the antennæ are six-jointed, the first three joints longest, the fourth and fifth shortest.

The adult female before impregnation is of a similar shape, but the terminal lobes of the abdomen are more developed. Each segment is covered with spiny spinnerets secreting wax. The antennæ are six-jointed, second and third longest, fourth and fifth shortest. There is an elongated protuberance each side of the antennæ. The legs are short and slender, with the tibia shorter than the tarsus. The genito-anal ring has eight hairs.

The full-grown male larva has seven-jointed antennæ, joint 7 longest, the rest equal. After impregnation the female becomes more round, fixes herself, the secretion becomes much more abundant on the sides, making at first lammellæ, which afterwards unite into a continuous cushion. The back becomes smooth and the segmentation is plainly visible. The dorsum is plane transversely, but curved longitudinally. Particularly after the birth of the young, the female becomes well separated from the waxy cushion, and is easily removed from it (even jarring will accomplish the removal), leaving the noticeable empty white cup with its fringed edges.

In describing the male, Mr. Howard says that an active form with wing pads issued some days before fully fledged males were noticed.

The antennæ of the male are ten-jointed, the joints well separated; the wings are represented by pads of varying length. The poisers appear rather thick and fleshy, but lack the terminal hook. The abdomen is very stout, sub-oval, considerably broader than the thorax, and when seen from above covers coxæ, trochanters, and base of the femora. Its segments are not well marked. A few days after this form makes its appearance the cocoons begin to give out the perfect males, which issue with wings fully expanded. There seems to have been a molt between this pseudimago and the perfect males, for in no other way can we account for the difference in form. The antennæ possess the same number of joints (ten), of about the same relative proportion, although joints 3 and 4 are longer, but the incisures are rather better marked. The poisers are lighter in color and less fleshy in appearance, and the curved hook is plainly visible at tip. The abdomen is rather longer, much more slender, and tapers gradually from base to tip. Its segments are well incised and plainly separable from above. It does not cover the hind coxæ and trochanters. The tibiae are longer in proportion to their tarsi. The anal segment gives off two waxy filaments as long as the entire body. These filaments were not noticeable in the pseudimago.

The cocoon of the male is rather close, though thin, flattened oval, and pure white, about 2 mm. long by 1 mm. wide, and is composed of rather coarse wax fibers.

There appears to be but one generation of the scale each year and the young are brought forth alive in May and locate on the leaves, where they grow rapidly, afterwards locating on the branches.

An effort will be made this fall and winter to stamp out this destructive pest.

*Remedies.*—Rosin solution for winter use. The following are the proportions of materials for winter wash:

Rosin .....	30 pounds.
Caustic soda (70 per cent) .....	9 pounds.
Fish oil .....	4½ pints.
Water .....	100 gallons.

Place the rosin, caustic soda, and fish oil in a large boiler, pouring over them about twenty gallons of water, and cook thoroughly over a brisk fire for at least three hours; then add *hot* water, a little occasionally, and stir well, until you have not less than fifty gallons of hot solution. Place this in the spray tank and add cold water to make the necessary amount. Never add *cold* water when cooking.

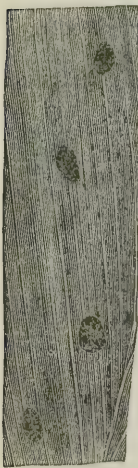
Summer remedy, to be used as soon as the scales have hatched. Directions for making emulsion:

Kerosene oil (150° test) .....	5 gallons.
Common laundry soap (or 1½ bars, usually sold as pound packages) .....	1½ pounds.
Water .....	2½ gallons.

Dissolve the soap by boiling in two and one half gallons of water. Then remove from the fire and add the oil to the hot soap water and churn violently for fifteen minutes, or until it has the appearance of butter. After above is emulsified, use by diluting one gallon of the mixture to six and one half gallons of water, and add two and one half pounds of home-made soap, dissolved in a little boiling water, to the solution (all the mixing is done with hot water), and apply at a temperature of 140° Fahrenheit.

#### THE DEPRESSED SCALE.

##### *Lecanium depressum*, Tar-Toz.



A dark, flattened, oblong scale, frequently found upon palms and other plants imported from the Sandwich Islands. It resembles a full-grown "soft orange scale" (*L. hesperidum*), but is darker. From the amount of black smut and the dirty appearance of the infested plants, I consider this would be as troublesome a pest as the other *Lecaniums* that have gained a foothold in the State. Maskell reports this species as occurring in New Zealand and Europe. The following is his description of the female; the male is unknown:

*Adult Female.*—Elongated, somewhat acuminate at the cephalic end; slightly convex; reddish brown; skin marked with two dorsal keels and numerous irregular tessellations, finely punctate. Antennae of eight joints; on the first two and the last three joints, some hairs. Feet normal, rather long; one of the lower digitules is larger than the other. Length of insect about one tenth of an inch.

#### PINE TREE SCALE.

##### *Lecanium insignicola*.

This is a large black, almost spherical scale, found on the Monterey pines (*Pinus insignis*) in a portion of Golden Gate Park, San Francisco; also upon the same pines planted on the hills back of Oakland.





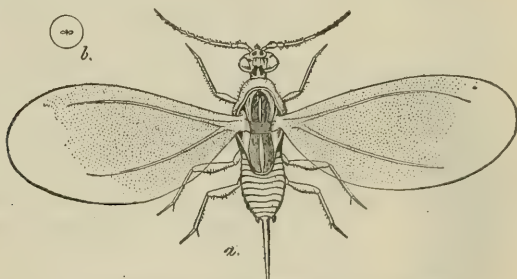
The infested trees presented a sickly, stunted appearance, with scant foliage, and covered with honey-dew and black fungus. The scales cluster thickly around the small shoots. They are oviparous, with but one generation a year. The young are elongated, dark brown in color, with a short fringe along the edges, and a deep abdominal cleft. As soon as they hatch they attack the tender pine leaves, and afterwards remove to the shoots, where they locate permanently. Commissioner Pryal, of North Temescal, found a cherry tree infested with this scale. It was growing near an infested pine, and the scale presented the same spherical form and gregarious habits as those upon the pine. Last season the pines in the infected district of the park had a much healthier appearance, and on examining the scales I found a large percentage with a small circular hole through the back, indicating the work of an internal parasite. It is to be hoped that the parasite will increase sufficiently to keep the scale down. In October last a strong colony of the "black ladybird" (*Rhizobius ventralis*) was placed among them, and they will undoubtedly do good work.

#### MALE OF THE BLACK SCALE.

*Lecanium oleæ*, Bernard.



Male pupa, enlarged.



a Winged male, enlarged. b Natural size.

The black scale is an old and widely distributed pest. It was known at Nice, and did considerable damage to the olive trees in that neighborhood as far back as 1743. In other sections of Europe it is very troublesome. It is also known in New Zealand, Australia, and the Sandwich Islands. I have also found plants from Japan infested with this scale, showing the existence of it in that country. Here in California it has been known for thirty years. Citrus, olive, and apricot culture in the coast counties has been seriously injured by its attacks. The humidity is more conducive to their increase and the growth of the black fungus than the warm interior sections. The great quantity of honey-dew discharged by them and falling on the upper surface of the foliage and fruit, forms a suitable propagating bed for the spores of the fungus to adhere to and grow in. With such a wide distribution, and the fact that it has been known so long, it is remarkable that the male insect—although diligently searched for—has been unknown and was generally supposed not to exist. The honor of its discovery belongs to Mr. B. W.

Griffith, a careful and enthusiastic microscopist of Los Angeles, California. While examining some black scale on oleander bushes during the latter part of January, he found some male pupæ, from which he bred the perfect winged male. His observations were continued and he found the males developed through February, March, and the early part of April. In a recent letter from Mr. Griffith, he informs us that the males began to issue from the pupæ the last week of November. This would indicate a period of five months that the males can be found in the winged state. Mr. Griffith kindly furnished the microscopic slides from which the accompanying drawings were made. The following is his description of the pupa and adult male:

*Description. Pupa.*—Dark gray, varying in length from 1 to 1.5 millimeters; width, from .5 to .8 millimeters. Dorsum with a distinct longitudinal carina and two delicate transverse carina.

*Winged Male.*—Orange color with lighter colored wings. Length of body, exclusive of style, 1.2 millimeters; style, .4 millimeters; anal plates, .5 millimeters. Antennæ ten-jointed, the first three joints are short, the second is swollen and pyriform, the fourth is longest and equal to the three first; the balance of the joints gradually diminish in size; entire length of antennæ, .55 millimeters; wings, 1.1 millimeter; legs slender and about .8 millimeters in length. Eyes six in number—two anterior compound, two ocelli at sides of head, and two compound eyes at posterior part of head.

Like the males of other scale insects, their existence is short after they reach the winged state.

#### THE ORANGE CHIONASPIIS.

*Chionaspis citri*, Comstock.



The cut represents the stem of an orange tree infested with this scale, received from Australia. Citrus trees, also holly-like shrubs (*Osmanthus ilicifolius*), received from Japan, were also found infested with this injurious insect, so the trees and shrubs were destroyed. Prof. H. A. Morgan, of Baton Rouge, La., in his treatise on "Scale Insects of the Orange in Louisiana," has the following in regard to this pest:

When trees become badly infested they present an appearance, due to color of the male scale, resembling white dusted meal, upon the trunk and branches. This scale does extend its work of destruction into the tender branches, and in such cases acts with the rapidity of the dreaded *Mytilaspis Gloverii*.

This insect is very prevalent in this State, being found from New Orleans to the Gulf. By extracting the juices from the tree it causes bursting and very ugly wounds in the bark, and many of the half rotten trunks of the older trees might be traced to the bursting of the bark caused by this insect.

From the above it will be seen that this is not a desirable insect, and orange and lemon growers should keep a sharp lookout for it. If found I would advise the destruction of the infested trees in order to stamp it out.

The following is Professor Comstock's description of this pest. He reports having received it from Havana:

*Scale of Female.*—The scale of the female is of a dirty blackish-brown color, with a gray margin; the exuvie are brownish yellow. There is a central ridge, from which the sides of the scale slope like the roof of a house. The greater prominence of this ridge and the more elongated form of the scale are the principal differences between this scale

and that of the female of *C. euonymi*. There are no groups of spinnerets; the mesal lobes are larger and more distinctly serrate than in *C. euonymi*; and in the last-named species the plates are in twos, while in *C. citri* they occur singly.

The male scale is narrow, of a clear white, and more readily detected than the female. There is a ridge from the molt to the posterior extremity. The edges of the scale recurve. The exuvia is light yellow to brown.

#### THE LONG SCALE.

##### *Mytilaspis Gloverii*, Packard.

The cut represents a specimen branch taken from a shipment of orange trees received last spring from Japan. The trees were only two years old from the graft (citrus trees are grafted instead of budded in Japan), and even in that time portions of the bark were completely covered with this narrow but destructive scale. The trees were burned. Eleven hundred and fifty-seven boxes of oranges arrived at the port of San Francisco from San José del Cabo, Mexico, on September 15th, infested with this pest. All the infected oranges were destroyed and the others fumigated with hydrocyanic acid gas. This scale is also found in Europe, Florida, and Louisiana. I am not aware that it has yet obtained a foothold in California.

The female of this species resembles the "purple scale," but differs in being straighter and narrower, and in color it is yellow to dark brown. The ventral scale is white, very thin, and split longitudinally, showing the eggs arranged in two layers. In this characteristic it differs from the purple, and can be readily distinguished from the latter. The body of the female is light purple in color, with the last segment yellowish. The eggs are white when first laid, but become tinged with purple before hatching. The male scale is similar in form to that of the female, but smaller and very seldom curved.



#### PURPLE SCALE.

##### *Mytilaspis citricola*, Packard.

Four years ago two carloads of orange trees were received in this State from Florida, and planted in Los Angeles and San Diego Counties without disinfection. The result is that the climate that has been preached up by importers of Florida stock as unfavorable to the development of this species of scale has proved to be the opposite, for on my visit to the above counties last summer I was shown trees that were completely covered from the ground to the young leaves and fruit. An active fight of extermination has been started against this scale by the Quarantine Guardians and the fruit growers in the infected districts, and I hope it will be vigorously pushed until every purple scale is exterminated.

All Florida-grown trees in the State should be carefully examined, and all trees found infested should be cut back and the stems scrubbed with whale-oil soap or rosin solution,  $\frac{3}{4}$  of a pound of the former to each gallon of water; the rosin, as directed for citrus trees. The other citrus



trees in the immediate vicinity of infested trees should be fumigated with hydrocyanic acid gas, even if no trace of scale can be found upon them. The scale of the female is long, slightly curved and widened posteriorly. It is brown, with a purple tinge; the exuviae brown, with a delicate margin; ventral scale is well developed and of a dirty white color; it is a single piece attached to the lower edge of the scale, and is more or less incomplete posteriorly. Length of scale, .12 of an inch. The color of the female is pale yellow. The eggs are white and placed irregularly under the scale. The scale of the male is usually straight, of the same color as that of the female; in some specimens they are dark brown, almost black, and measure .06 of an inch.

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## IX.

### BENEFICIAL INSECTS.

The importance of predaceous and parasitic insects has been more fully demonstrated in California than in any other country of which we have any record. The people of no other State or nation have labored more to make a success of their introduction, propagation, and distribution, and our experience justifies the hope that we will ultimately find a natural check for each and all of the devastating pests that attack garden, field, and orchard growths and products. This cannot be accomplished on one mission in quest of beneficial insects, or in one season's work in breeding and distributing such insects. But this Board proposes to continue its efforts in this direction, as well as to guard the horticultural interests by preventing the introduction and spread of new pests. We frequently receive specimens of ladybirds and other beneficial insects for determination, and in some instances with details of efforts made to destroy them under the belief that they were injurious. The two colored plates appended to the Board report, showing their natural size and color, will aid the fruit growers in distinguishing between them and the more common of our insect friends. Colored Plate I shows the recent importations from Australia, by Prof. Albert Koebele, of Alameda, under the directions of the State Board of Horticulture. Professor Koebele's discovery of the *Vedalia cardinalis* and its successful introduction and work in destroying the "cottony cushion scale" (*Icerya purchasi*) in this State, have given him a world-wide reputation. A brief mention of a few of the beneficial insects that have played a very important part in protecting the great fruit industry of California will be of interest under this head.

The first pest that the orchardist was confronted with was the "soft orange scale" (*Lecanium hesperidum*), introduced over thirty years ago. Orchards were not very numerous or extensive in those days, but around Los Angeles several old orange trees and a few promising young groves were to be found. The trees were deep green and vigorous, and the fruit bright and clean. In some way this scale was introduced and spread with alarming rapidity from tree to tree and from orchard to orchard. Some of the old trees succumbed to their attacks, and the dead stumps were dug out. The orchardists had no spraying outfits or fumigators, so they resorted to scrubbing brushes and soap suds, with which the

trunks and large limbs were disinfected. After a few years the scales began to diminish in numbers and the trees recovered, and it was supposed that the pest had run its course and would finally disappear. A closer inspection of the scales showed the presence of internal parasites, and to their presence we are indebted for keeping this scale under subjection at the present time. One of the parasites is *Encyrtus flavus*, and the other is *Coccophagus lecani*. Both are chalcid flies, and hardly discernible with the naked eye.

The "cottony grape scale" (*Pulvinaria innumerabilis*) was found in different parts of the State fifteen years ago, infecting grapevines, especially those trained on arbors. The *Encyrtus flavus* developed a taste for it, and has stamped the scale out. The "common mealy bug" (*Dactylopius adonidum*) did considerable damage to the orange in Los Angeles in 1882 to 1886. This pest would congregate and breed in the clusters of fruit, especially around the stem and where two oranges touched each other. The fruit was so covered with honey-dew and fungus that the oranges dropped. In 1886, I discovered a beautiful new chalcid fly at work amongst the *Dactylopius*; it was afterwards named *Rileyia splendens*. This parasite was very effective. In 1872, the "yellow scale" (*Aspidiotus citrinus*) was introduced into the San Gabriel Valley on orange trees from Japan, and by 1886 had spread to nearly all the groves in that beautiful section. The foliage was yellow and the fruit covered with scale. In 1888, an internal parasite was found preying on the scale, and has spread to all the groves. The district where the pest was the most serious is now practically free from "yellow scale." The parasite *Coccophagus citrinus* is a native of Japan. I have bred it from a few scales found on imported trees. It is the smallest parasite found on the scale insects that infest fruit trees in this State.

Another insect that for years damaged the deciduous fruit trees of the State is the "pernicious scale" (so-called San José scale), *Aspidiotus perniciosus*. The destruction caused by this pest is well known. Within the past four years this scale has been slowly but surely disappearing. The orchards in the neighborhood of San José are practically free from it, and other districts of the State show the same results from the work of beneficial insects. In this instance we have three species that are active in the good work. One is an internal parasite *Aphelinus fuscipennis*, and the others are ladybirds, the "brown-necked" (*Rhizobius Toowoombæ*), and the "twice-stabbed" (*Chilocorus bivulnerus*).

The "brown apricot scale" (*Lecanium armeniacum*), found in some districts to seriously injure apricot and prune trees, received a check eighteen months ago in the Berryessa district of Santa Clara County. Over 90 per cent of the scales had holes in their backs, through which the parasites *Comys bicolor* had made their escape.

The most convincing proof of the value of parasites has been the introduction of the *Vedalia cardinalis*, already referred to. Figs. 8, 9, 10, 11, 16, and 17, colored Plate II, represent this ladybird in different stages, natural size and enlarged.

From the foregoing list and account of benefits derived from parasites, fruit growers can see the importance of further appropriation by the Legislature for the introduction of beneficial insects.

## TWO-SPOTTED LADYBIRD.

*Adalia bipunctata*, Linn.

[Fig. 28, Plate II.]

This ladybird is very distinct, having red wing-covers with a black spot on each, hence its specific name. The thorax is yellow, with black marking in front in the form of a W. When in the Eastern States four years ago, Mr. B. M. Lelong collected three large colonies of this species and forwarded them to this State. They feed principally on aphids.

*Anatis subvittata*, Mulsant.

[Fig. 20, Plate II.]

This is one of our largest ladybirds, found principally in the northern counties of the State. It is brownish yellow, with black markings; head black; thorax black, with broad light-colored margins. At the base of the suture are two light-colored spots; the black markings on each elytra resemble the figure 5. This species feeds upon aphids, but are not very numerous.

## TWICE-STABBED LADYBIRD.

*Chilocorus bivulnerus*, Mulsant.

[Figs. 2 and 3, Plate II.]

This is one of our most important native ladybirds. The larvæ are the most voracious, and destroy great numbers of young "black," "pernicious," and other scales. The young, as shown in Fig. 3, is long and covered with dark spines. It is crossed with a yellowish band near the middle. When about to change into the pupa or chrysalis, it selects the underside of the large branches, where it attaches itself with a gummy substance to the bark, head downward. In a few days the larval skin splits longitudinally, exposing the inclosed chrysalis. When the beetle issues from the chrysalis it has a black head, with white wing-covers; in a short time this changes to a shining black, with a red spot on each elytra. In this stage it also preys on scale insects. This beetle has been widely distributed within the past three years.

## ASHY-GRAY LADYBIRD.

*Coccinella abdominalis*, Say.

[Fig. 27, Plate II.]

This beetle, together with *Hippodamia convergens*, did good in subduing the walnut aphids this season in the southern counties, and as a result the trees were free from smut. The ladybird is hemispherical in form, of an ashy-gray color, with seven small black spots on the thorax and eight on each wing-cover.



## CALIFORNIAN LADYBIRD.

*Coccinella Californica*, Mann.

[Fig. 21, Plate II.]

This species is very common throughout the State, and resembles the ambiguous ladybird. The elytræ are orange-red, without spots or markings; thorax is black, with a light spot on each side. They feed principally upon aphids. Like other species of ladybirds, the larvæ do the most good.

## 22-SPOTTED LEIS.

*Coccinella (Leis) conformis*, Boisd.

[Fig. 5, Plate I.]

This is a beautiful yellowish-brown ladybird, with black markings, introduced from Australia in 1892. They feed principally upon aphids infesting orange trees, and woolly aphids on apple. In Australia it is claimed to do good work in keeping those pests down. The larva of this species is not furnished with hairy spines like the *Orcus*, but is provided with small fleshy projections on the lateral margins.

## EYED LADYBIRD.

*Coccinella oculata*, Say.

[Fig. 4, Plate II.]

This ladybird is frequently taken for the twice-stabbed species. In this species the spots are larger and reddish-yellow. The head and lower edges of the thorax are also the same color as the spots. They feed on scale insects, but are not very numerous.

## BLOOD-RED LADYBIRD.

*Coccinella sanguinea*, Linn.

[Fig. 25, Plate II.]

This is a small blood-red beetle, varying to a dull red. They are not very common. They feed on young scale and aphids.

## JULIAN'S BANDED LADYBIRD.

*Coccinella trifasciata*, var. *Juliana*, Mulsant.

[Fig. 24, Plate II.]

This is not a very common ladybird. Mr. Lelong reports having found them feeding upon black scale at Mission San José, Alameda County. In the summer of 1892 I observed numbers of them, together with *C. trifasciata*, in Del Norte and Humboldt Counties, feeding upon aphids infesting wild plants.

## PILATE'S LADYBIRD.

*Exochomus Pilatei*, Mulsant.

[Fig. 1, Plate II.]

This beetle resembles the twice-stabbed ladybird, but is much larger. It also differs from the latter in having the under side of the extremity of the abdomen black instead of red. The larva resembles the twice-stabbed, but is larger and lighter colored. Both the larva and beetle feed upon young black scale, but they do not appear to increase very rapidly.

## CONVERGENT LADYBIRD.

*Hippodamia convergens*, Guerin.

[Fig. 22, Plate II.]

The illustration gives a good idea of the markings of this valuable beetle, although various shades of red to pale yellow can be found, and occasionally, when food is scarce, the beetles will be smaller and one spot less near the base of the wing-covers. Reports have been received this season from Santa Barbara and other coast counties, also from Sacramento, of the good work of this species in destroying the woolly aphids on apple trees.

## AMBIGUOUS LADYBIRD.

*Hippodamia ambigua*, Le Conte.

[Fig. 23, Plate II.]

Like the preceding species, this one is common throughout the State, feeding upon aphids, which they soon destroy. During the fall and winter, when food is scarce, they frequently can be found in great clusters hibernating.

*Hyperaspis lateralis*, Muls.

[Fig. 5, Plate II.]

A small black ladybird, resembling *Exochomus marginipennis*, with two reddish-yellow spots on the elytra near the apex, two spots on the disc, and two blotches of the same color on the forward lateral margins. Forehead and edge of thorax yellow. Feeds on pernicious scale in the adult form.

Cypress trees (*Cupressus macrocarpa*) in the suburbs of San Francisco, that were seriously infested with the "cypress mealy bug" (*Dactylopius Ryanii*), were cleared of the pest by this ladybird. The larvae of this species are covered with a cottony secretion, and resemble mealy bugs.

## STRIPED LADYBIRD.

*Megilla vittigera*, Mannerheim.

[Fig. 26, Plate II.]

This ladybird is brown, with three dark stripes, and would be readily confounded with the striped squash-beetle (*Diabrotica trivittata*), but can be distinguished from it, as the latter has a yellow thorax and long antennæ. They are mostly found in swampy lands, and are supposed to feed on aphids.

## KOEBELE'S LADYBIRD.

*Novius Koebelei*, Olliff.

[Figs. 3, 3a, 3b, 3c, 3d, and 4b, Plate I.]

Introduced in 1892 from Australia, bred in San Francisco, and distributed in Los Angeles, Alameda, Sacramento, Napa, Sonoma, Santa Clara, and Sutter Counties.

The illustrations give a good idea of this beautiful and active little ladybird. It feeds upon the cottony cushion scale (*ICerya purchasi*), searching out the solitary scales even better than the *Vedalia*. It passes through its different stages in about the same time as the latter. With those two ladybirds and the small dipterous fly, *Lestophonus iceryæ*, in the State, we have nothing to fear from the "cottony cushion scale."

## SIX-SPOTTED ORCUS.

*Orcus Australasia*, Boisdu.

[Figs. 2 and 2a, Plate I.]

This is another recent importation and is well established at Ellwood, Santa Barbara County. They are also breeding in Los Angeles and Alameda Counties. The female is nearly one fourth of an inch in length, deep blue in color, with six orange-red spots on the wing-covers. The male is similarly marked, but a smaller insect. This species is a more general feeder than *O. chalybeus*. In the former county it bred on "black scale," in Los Angeles on the "red," and in Alameda on the "pernicious" scale. It loves the sunshine, and is found more numerous toward the top and the outside branches. Mr. Cooper writes, under date of December 23d: "The *Orcus Australasia* are hiding away after the manner of the common red ladybird"—[clustered together]—"one place I saw as many as a double handful."

The larva and pupa resemble the same stages of Pilate's ladybird.

## STEEL-BLUE LADYBIRD.

*Orcus chalybeus*, Boisdu.

[Fig. 1, Plate I.]

A beautiful steel-blue, hemispherical ladybird, introduced from Australia by Mr. Koebele on his last mission to that country. This species appears to breed rather slowly as yet, but Mr. Koebele reports it to be



the most numerous of the ladybirds found feeding upon "red scale" (*Aspidiotus aurantii*) in Australia. We hope that when it becomes thoroughly acclimated it will sustain the high opinion entertained of it by its introducer. During the winter they hide away until May, and by July the first brood have changed to beetles; another brood issues in August and September.

The female (Fig. 1b) measures two twelfths of an inch in length, of a uniform steel-blue. The male, as shown in Fig. 1a, has a light yellow prothorax, and is slightly smaller than the female.

#### TWENTY-SPOTTED LADYBIRD.

*Psyllobora 20-maculata*, Le Conte.

[Fig. 6, Plate II.]

This is an active and widely distributed little ladybird. It is very numerous, but so shy that the slightest movement of the leaves on which it is searching for food will cause it to drop. They resemble the ashy-gray ladybird in color, but only measure about one tenth of an inch in length. They feed on the larvæ of scale insects and red spider.

#### BROWN-NECKED LADYBIRD.

*Rhizobius Toowoombæ*, Blackburn.

[Fig. 7, Plate II.]

This little beetle was formerly described under the name of *Scymnus marginicollis*, but is identical with *Rhizobius Toowoombæ*, an Australian species, and probably has been introduced from that country. Mr. Koebele sent this beetle about the time that he introduced the *Vedalia*, but it was found in the State previous to that. However, it has only been within the past four years that its value has been observed. It should be credited with a large portion of the work of ridding certain districts of the "pernicious scale." It breeds from early spring until late in the fall. As compared with the beetles the larvæ are very large; they are light colored and remain a long time in this stage, feeding voraciously. When about to change to the chrysalis they hide away under cobwebs, dry leaves, and other debris. The beetle is metallic black, with a brown thorax. They also feed on *Aspidiotus perniciosus*, *A. aurantii*, *A. citrinus*, *A. Nerii*, and occasionally on aphids.

#### BLACK LADYBIRD.

*Rhizobius ventralis*.

[Plate III.]

This valuable little ladybird is one of Mr. Koebele's last importations from Australia, and was successfully bred by Hon. Ellwood Cooper, at Ellwood, Santa Barbara County. It is jet black, but covered with short fine hairs that give it a dark gray appearance. The male measures one eighth of an inch in length, and the female three sixteenths of an inch.

Mr. Cooper received a few pairs alive of this ladybird in May, 1892, and during September, 1893, they had increased so that they practically stamped out the black scale (*Lecanium oleæ*) in the olive orchard where he placed them. During the second week of October he distributed, upon application, 453 colonies of from twenty-five to fifty ladybirds in each. Another distribution will be made in May next. December 23d, Mr. Cooper wrote in regard to this ladybird: "I find that the larvæ of all sizes are plentiful." This will show that they breed through nearly the entire year. As the black scale is distributed through all the coast counties of the central and southern districts, this little beetle will ultimately prove as valuable as the *Vedalia cardinalis*. Reports from a number of the parties to whom colonies were sent have been received, stating that the larvæ are plentiful on the trees where the beetles were placed.

The illustration will give a good idea of the appearance of the larvæ. The natural size is indicated by the line at the side. They are dark gray and fringed with short spines.

#### AUSTRALIAN LADYBIRD.

*Vedalia cardinalis*, Mulsant.

[Figs. 8, 9, 10, 16, and 17, Plate II.]

The introduction of this little ladybird into California saved the citrus industry from destruction by the Australian "cottony cushion scale" (*Icerya purchasi*). The orange growers of Los Angeles County especially had a very expensive experience with this scale. As it had spread into the wild bushes and trees, extermination by artificial means was out of the question. Now the scale has a hard struggle for existence. When it appears in an orchard the owner is supplied with a colony of the *Vedalia* and requested to forward a box of the scale-infested branches to supply our colonies in the breeding jars. Fig. 9, Plate II, represents the larva or young; Fig. 10, the chrysalis, and Fig. 8, the perfect beetle, natural size. Figs. 16 and 17, enlarged, give a better idea of the markings of the beetle and larva.

During the summer the transformations of this ladybird are very rapid. From the egg, through the larva and chrysalis, to the perfect beetle takes only twenty-one days. Of course, the larvæ are the most active feeders. When short of food they will attack each other, but no matter how hungry they are they will not eat any other species than the cottony cushion scale. This ladybird breeds throughout the year.

#### A LEPIDOPTEROUS ENEMY OF THE BLACK SCALE.

*Thalpochares coccophaga*, Meyr.

[Figs. 6 and 6a, Plate I.]

The chrysalis of this moth was sent by Mr. Koebele, in the spring of 1892, from Toowoomba, Australia. During May and June the moths issued and were liberated on orange and lemon trees infested with "black scale" (*Lecanium oleæ*), at Haywards, Alameda County. A

colony was placed at Ellwood, Santa Barbara County, and several colonies went to Los Angeles. Nothing has been seen of either lot, but I have no doubt but that they will be found the coming season, as they were in good condition when turned loose. We had a similar experience with the Australian fly (*Lestophonus iceryæ*). Nothing was seen of the latter for over two years after it was imported. The larvæ of this moth travel along infested twigs, destroying the black scale as they go, using the dry scales as a protection to their naked bodies and covering to the chrysalis.

#### LACE-WINGED FLY.

##### *Chrysopa Californica*, Coquillett.

[Figs. 11, 13, 14, 15, and 29, Plate II.]

The larvæ of this beautiful pale green fly are predaceous, destroying aphids and other soft insects. Unfortunately they do not discriminate, but kill the young of ladybirds and other beneficial insects. They are found throughout the State, but not very plentifully, as they are preyed upon while in the pupa stage—Fig. 29, Plate II—by an internal hymenopterous parasite.

#### BROWN LACE-WINGED FLY.

##### *Hemerobius*.

[Fig. 19, Plate II.]

This resembles the preceding species, but differs in color, being brown instead of green. The larva, after having extracted the juices from its victim, throws its head backwards and attaches the skin of the aphid to its back, thus forming a covering for its body, and to some extent a protection against insectivorous birds.

#### SPINE-LEGGED SOLDIER BUG.

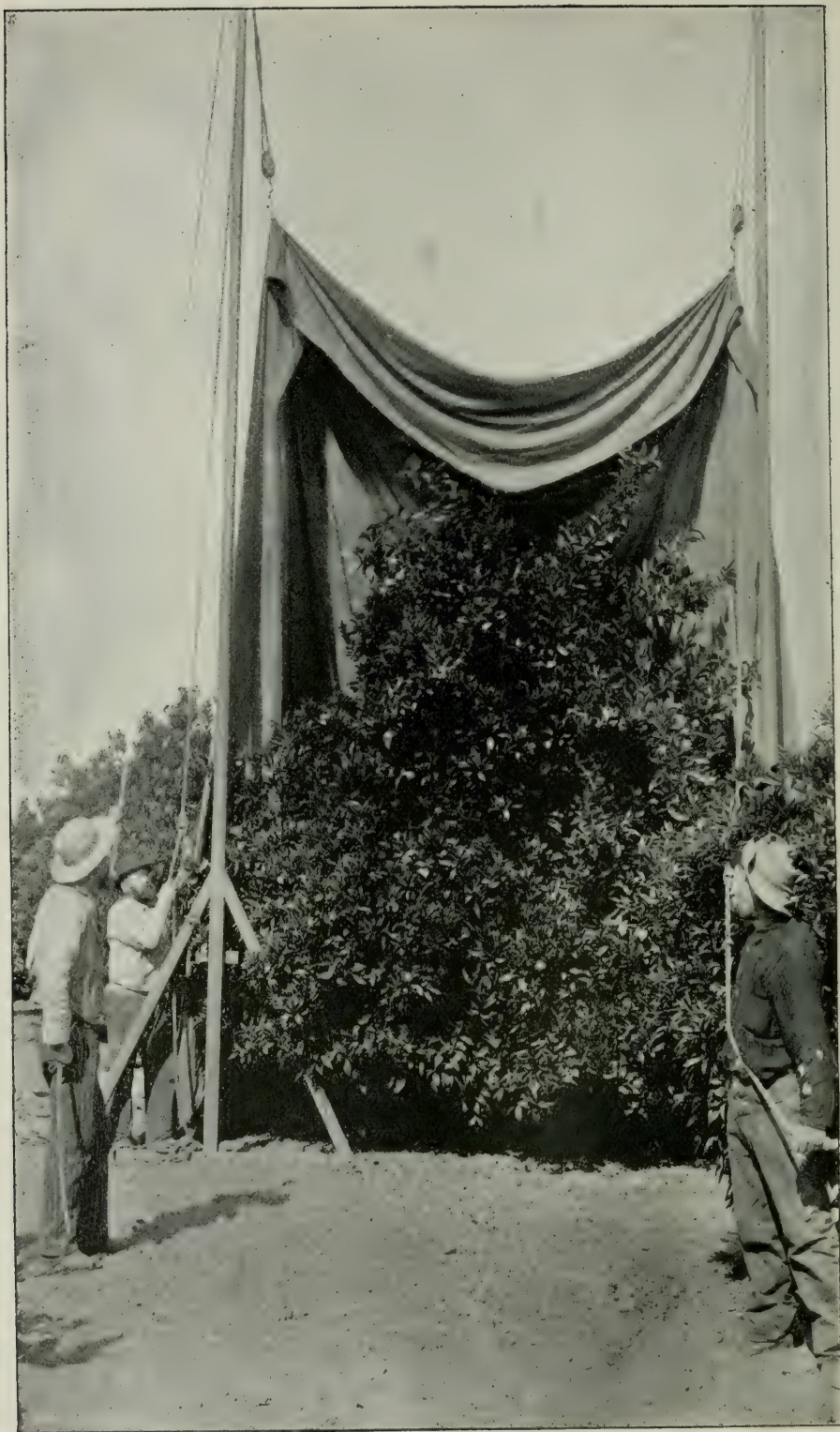
##### *Sinea spinipes*, Herrick-Shaefer.

[Fig. 18, Plate II.]

This insect, both in the larval and adult stages, feeds upon aphids, caterpillars, and other soft-bodied insects. Even the larvæ of the ladybirds are attacked by them, so they are both beneficial and injurious. They are furnished with a short, stout proboscis, with which they kill their prey and extract the juices. Like the mosquito, they inject a poisonous fluid into the wound, and a bite from them will produce great pain and cause the part to swell.







Improved apparatus (No. 1) for treating citrus trees with hydrocyanic acid gas.



Improved apparatus (No. 2) for treating citrus trees with hydrocyanic acid gas.





## GRAY SOLDIER BUG.

*Euschistus tristigmus*, Say.

[Fig. 12, Plate II.]

Like the spine-legged soldier bug, this insect is predaceous, and destroys plant lice and caterpillars. They are dark brown in color. Their proboscis, when not in use, is folded under the breast.

## SYRPHUS FLY.

*Catabomba pyrastris*, Linn.

[Fig. 30, Plate II.]

These flies, as shown by the illustration, resemble wasps. During the spring and summer they can be seen hovering near plants or trees infested with aphids, amongst which they deposit their small, light-colored, oblong eggs, usually one in a place, unless it is a very large colony of aphids. This is a wise provision of nature, as the larvæ, or young, are totally blind. As soon as hatched the young maggot feels around until it strikes an aphid, which it will seize and suck the juices therefrom. As they increase in size and strength they raise the aphid from the twig or leaf. The larvæ are sometimes gray, changing to green. The smaller end is the head. When about to change to the chrysalis, they attach themselves to the leaf, the body becomes shortened, distended, and pear-shaped.

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X.

## GAS TREATMENT FOR DESTROYING SCALE INSECTS UPON CITRUS TREES.

Hydrocyanic acid gas is still considered the most effective means of combating the "red" (*Aspidiotus aurantii*), the "purple" (*Mytilaspis citricola*), and other armored scales that have as yet no effective parasite to keep them in check. This gas is produced by the chemical action of sulphuric acid upon cyanide of potassium. The proportions of chemicals necessary for different sized trees near the coast and in the interior are given in separate tables.

To prepare the gas, the following instructions must be carefully observed. This gas is deadly, so care must be taken not to inhale it as it issues in a volume from the generating pot. When mixed with the air there is less danger, but at no time should the operator breathe it. In removing the tent from the tree after treatment, the men should stand to the windward, but usually this gas is all condensed or spent before it is necessary to transfer the tent to another tree, so that there is really no risk. Place the necessary amount of cyanide of potassium, together with sufficient water, in an earthenware vessel; when the tent or canvas has been put over the tree and everything is in readiness, place the vessel under the canvas and add the sulphuric acid; a piece

of sacking or burlap should be thrown over the top to spread the gas and prevent it from burning the leaves immediately above the generator. The tent must be made air tight around the bottom as soon as the acid is put in. This can be done by simply throwing some loose soil over the bottom of the canvas. Some operators prefer to mix the acid and water first and drop the cyanide in last. The brand of cyanide of potassium that has given the most satisfaction and most uniform results is the fused (60 per cent), manufactured by Powers & Weightman, of Philadelphia, Pennsylvania. It should not be left exposed, as it has a strong affinity for water and withdraws the moisture from the air, thus adding considerably to its weight.

The following table, giving height of trees and the proportions of chemicals and water, will be found suitable for districts in the interior or beyond ten miles in a direct line from the sea coast:

Height of Tree—Feet.	Diameter through Foliage—Feet.	Water—Fluid Ounces.	Sulphuric Acid—Fluid Ounces.	Cyanide of Potassium—Ounces.
6	4	2	1	1
8	6	4	2	2
10	8	6	3	3
12	10	10	5	5
12	14	14	7	7
14	14	16	8	8
16	16	18	9	9
18	16	20	10	10
20	16	22	11	11
22	18	24	12	12
24	20	26	13	13
26	20	27	13½	13½
30	20	28	14	14

One would suppose that a tree having a dense foliage would fill up the space within the tent and require less gas to be effective. But the cold surface of the leaves condenses the gas, and fumigators find that a slightly heavier charge of chemicals is necessary for such a tree, and where the foliage is scant a less amount than is given in the table will answer. Some orchardists and fumigators consider that the work has not been effective unless some of the leaves or tender twigs have been injured. This is not necessary, for in our early experiments we have treated trees and killed the scale without even injuring the most tender twig or blossom. As the trees recover very quickly, even when seriously scorched, a slight burning is no detriment and is evidence that the work has been effective, except in the case of "black scale" (*Lecanium oleæ*), during the early summer when the eggs are under the females. The proper time to fumigate for this scale is during the fall or early winter, when they are in the larva state.

Mr. T. B. Johnson, formerly of Riverside, superintended the fumigating work carried on by the San Diego Horticultural Board during the past season in the bay district, and after experimenting with the same grades of cyanide of potassium and sulphuric acid, found it necessary to increase the amounts on large trees in order to do good work. The following table was finally adopted by him for use near the coast. We have had the same experience in disinfecting imported stock in the bay district of San Francisco:



Height of Trees— Feet.	Diameter through Foliage—Feet.	Water—Fluid Ounces.	Sulphuric Acid— Fluid Ounces.	Cyanide of Potas- sium—Ounces.
6	4	3	1½	1
8	6	6	2½	2
10	8 to 10	12 to 15	4 to 5	3½ to 4½
12	10 to 14	18 to 26	6 to 8¾	5 to 7
14	12 to 14	26 to 30	8¾ to 10	7 to 8
16	14 to 16	33 to 37	11 to 12½	9 to 10¾
20	16 to 18	48 to 56	16 to 18¾	13 to 15
24	18 to 20	67 to 75	22½ to 25	18 to 20

The cyanide should be used as coarse as possible, so that the chemical action will be less violent. The gas is also generated more evenly and there is not so much danger of the chemicals boiling over or spattering the tent. The tent should remain closed for not less than forty minutes. This time is required to kill the eggs of the armored scales. As soon as the tent is removed the vessel should be rinsed with clean water and prepared for another charge, while the men are changing the tent.

Los Angeles County has the largest and best fumigating outfit in the State. During the fumigating season two crews of four men each are detailed for this work, under the direction of the County Horticultural Commissioner. One crew operates with the "bell-tents" (Plate XXXVIII) upon trees under 14 feet high. R. T. Mullard had charge of this outfit, and with 29 tents 7½x6½ feet has treated 318 trees in one night, commencing at 5 P. M. (in October) and working twelve hours. With the same number of men and 16 tents he has fumigated 224 orange trees 10x12 feet. The tent used for this size tree is bell-shaped, 16 feet high by 32 feet in circumference. The tent in passing down over the tree brings the branches together without damaging them. The tent requires no other support than the tree. To keep the mouth of the tent expanded, and to facilitate moving it from tree to tree, the bell-tent has a large hoop made of half-inch gas-pipe; to connect the ends a short piece of larger pipe is used, through which two holes have been drilled. Corresponding holes are made in the hoop; through them are passed nails, which are clinched; this completes the circle. One foot from the bottom of the tent straps of canvas are sewed, and through them the gas-pipe is passed. In removing the tent the hoop is raised, one side is elevated over the top of the tree in the direction of the tree to be treated, turning the tent outside in. The apex of the tent is supported by a pole, at the end of which is a four-inch crescent-shaped iron rest. The two men handling the hoop pass it over the next tree and it is ready for gasing.

#### THE SHEET-TENT.

[Plate XXXVII.]

This is a very simple arrangement and has greatly reduced the cost of a fumigating outfit. The most successful operating fumigators heretofore have been modeled after the "Wolfskill" design—the first built. The "Titus," "Culver," and "Dobbins" fumigators could only be used successfully with one tent, so it was rather a slow business. The rolling stock and rigging connected with the "Wolfskill" and "Preble" apparatus made them too expensive, so a simpler and cheaper system of

covering large trees was a necessity. The sheet-tent and poles were the outgrowth of a suggestion made by Dr. J. H. Dunn, of Pomona, to Mr. Finch and Mr. Miller, of Riverside, with a few modifications by others since. The illustration is one of the Los Angeles outfits at work in Covina orange grove. The two poles, or uprights, are of dressed Oregon pine, 2x4 inches and 24 feet high. Across the bottom of the poles are bolted—one on each side—two pieces 1x3 inches and 6 feet long. From each end of the cross-pieces a brace, 2x4 inches and 4 feet long, is fastened to the upright pole. The cross-bar prevents the pole from falling sideways when raising the tent over the tree. A  $\frac{3}{4}$ -inch guy rope, 33 feet long, is fastened at the top of each pole in front. A 4-inch block is fastened in the rear at top, and another block where the braces join the upright; through these is passed a  $\frac{7}{8}$ -inch rope 70 feet long, to raise the tent. Instead of the rope with rings sewed to the canvas, to which a hook was attached for raising the sheet, the edge of the sheet is gathered and a hitch with the rope around it makes it fast, so it can be drawn up. This obviates the necessity of placing the sheet in a certain position and right side up, so it is a great saving of time. When all is ready the sheet is dropped on one side of the tree; the uprights are raised, one on each side; the ropes are adjusted to the edge of the sheet, and hoisted; each upright is steadied by a man with the guy rope. When raised sufficiently, the men pull on the guys, thus bringing the sheet forward and over the tree. The uprights are allowed to drop on the ground, leaving the tent in position. In operating, take the same number of rows of trees and tents that you can adjust within the forty or forty-five minutes required to gas a tree. In this way no time is lost. One set of uprights will answer for all the sheets. The sheets are made octagonal, and the sizes used are 32, 48, 52, and 60 feet in diameter.

#### FORMULA FOR PAINTING FUMIGATING TENTS.

In order to make the canvas used for fumigation perfectly air tight, to prevent the gas escaping, the tents have been treated with a light coat of boiled linseed oil. The great objection to the oil has been that it had a tendency to stiffen the canvas and add considerably to its weight, so a cheaper and more flexible preparation was sought. The following mixture, used by Commissioner Scott, of Los Angeles County, during the past season, made the tents gas tight and left the canvas soft and pliable. The chief essential ingredient is a supply of common prickly-pear cactus (*Opuntia engelmanni*) that grows in abundance in the southern counties of the State. It is the flat leaf species, and parties living in sections to which it is not indigenous could have it sent in boxes. To make the cactus extract, chop up enough cactus to fill a barrel two thirds full, then fill up the barrel with cold water. It should stand for twenty-four hours, when it will be ready for use. Do not prepare more than is required for immediate use, otherwise it will sour and become worthless. Stir well, then strain ten gallons of the liquid into another tub or barrel; dissolve two pounds of common glue and add to the cactus extract, with sufficient yellow ocher or Venetian red to give it a good body. After thoroughly mixing the ingredients, it is ready for use. Both sides of the canvas should be painted, and the dressing well rubbed into the fiber with a flat paint brush. If oil is used, the canvas should be spread out and thoroughly dried before it is rolled up, or it is liable

to be destroyed by spontaneous combustion. When dry there is no danger from this.

Dr. J. H. Dunn, of Pomona, a successful fumigator, dips all his tents in the following tannin solution, combined with the cactus preparation, and finds that the tents so prepared are more durable. He prepares the cactus and yellow ochre mixture as directed above. His method of treating the canvas or tents is as follows: He has a tank 8 feet long, made with sheet-iron bottom and plank sides 20 inches high. This is set on brick walls forming a fireplace and flue. Into this boiler he puts one sack of chopped or ground oak bark and one pound of catechu, covered with water and boiled for two hours, to extract the tannin. Then the cactus mixture is poured in and boiled for a short time. The tent is rolled up loosely and put into the hot solution, where it remains over night. In the morning it is hoisted with a block and derrick and allowed to drain and afterwards spread out to dry. Besides protecting the canvas from mildew and rot, he states that the hydrocyanic acid gas has no injurious effect upon the cloth.

In order to be successful in fumigating with hydrocyanic acid gas nothing but the best and closest texture of canvas should be used. Every day the tents should be carefully inspected to see that there are no holes, for no matter how small they are the gas will pass out and the work may be ineffective.

#### COMBINED REMEDY FOR CODLIN MOTH AND APPLE SCAB.

The Paris green solution has almost entirely superseded the band and trap system of fighting codlin moth (*Carpocapsa pomonella*). No matter how carefully the bands and traps were attended to, enough larvæ escaped so that there appeared to be as many wormy apples or pears the following season as before. With Paris green we destroy the worms before they have damaged the fruit. This is certainly more satisfactory to the orchardist, and requires less attention and work. Paris green is preferable to London purple, as it is insoluble in cold water, and therefore less injurious to the foliage. No ammonia or soap should be used in the solution. In the Eastern States a stronger spray can be applied without injury. But in California we find that one pound of Paris green to two hundred gallons of cold water is as much as the foliage will stand. The poison should be made into a paste before placing in the tank, and during the operation of spraying it should be *constantly* stirred.

If any indications of "apple scab" (*Fusicladium dentriticum*) are observed, the following can be added to the Paris green solution: Dissolve twenty-five pounds of sulphate of copper in twenty gallons of water; slack twenty pounds of fresh lime; add to the copper solution, and strain into the spray tank with the Paris green, making two hundred gallons of wash. This should be applied with a fine spray, and only sufficient used to each tree to thoroughly moisten it without running off. If the mixture has been constantly stirred, this will distribute sufficient Paris green over the young fruit to destroy the larvæ of the codlin moth before they burrow. The spraying should be done soon after the blossom drops, and before the fruit turns downward. A second application should be made about sixteen days after the first, and in some districts a third application (of Paris green), at three weeks interval from the second, will be beneficial.





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TRANSACTIONS

OF THE

SIXTEENTH STATE FRUIT GROWERS' CONVENTION,

HELD AT

SAN JOSE, NOVEMBER 15-18, 1892.

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XI.

TRANSACTIONS

OF THE

SIXTEENTH STATE FRUIT GROWERS' CONVENTION

HELD UNDER THE AUSPICES OF THE

STATE BOARD OF HORTICULTURE AT SAN JOSÉ,  
NOVEMBER 15 TO 18, 1892.

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CALLED TO ORDER.

Hon. Ellwood Cooper, of Santa Barbara, President, called the convention to order. He briefly explained the call for the convention issued by the State Board of Horticulture, and introduced Rev. R. S. Cantine, who opened the exercises with prayer.

VICE-PRESIDENTS.

Col. Philo E. Hersey and Col. R. P. McGlinicy, of San José, were chosen Vice-Presidents.

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ADDRESS OF WELCOME.

By HON. S. F. LEIB, of San José.

MR. PRESIDENT, LADIES AND GENTLEMEN: I feel myself incapable of giving you a description of this valley. Originally it was a sea. This was before there was a Golden Gate. The geologist tells us that in those times this inland sea covered not only this valley, but what is now the great valleys of the Sacramento and the San Joaquin. Into it flowed the waters of the Sacramento, San Joaquin, and other rivers, and it found its outlet through the southern end of this valley and thence on through the Pajaro Valley to the ocean. Just how near the water stood to the top of the lowest gap of the Coast Range opposite the present bay of San Francisco we cannot even surmise, but eventually it became high enough to pour through this gap, and the Golden Gate was probably then soon made. Large tracts of land were thereby drained and made dry. The rich soil of our surrounding mountains was washed into the basin where the water had been, and made this valley what it is. This is proven by the further fact that in boring our artesian wells, we frequently find redwood trees hundreds of feet below the surface. When I came here, nearly a quarter of a century ago, Santa Clara Valley was one vast grain field. I cannot recollect of then seeing an orchard having in its limits as much as ten acres. Now, behold the change! Where

now are those vast grain fields? Even you who were in attendance at the convention of this society some eight or ten years ago, will be astonished at the change since then. As an illustration of this, I may state that I had just planted an orchard in the western edge of this valley on what is known as the Stevens Creek road. That road is eight miles long and as straight as an arrow. Not a single orchard then fronted on this road but my own. Now there is not one quarter of a mile of it, all told, that has not an orchard or vineyard fronting on one or the other side of it, and generally on both sides. I had occasion last spring to drive an Eastern friend around a portion of this valley, and we agreed before starting, to keep account of all portions of the road that had no orchard or vineyard fronting on one or both its sides. That drive extended between twenty-five and thirty miles, and at its close we found that there was much less than one mile in all not fringed by orchards or vineyards.

Last year we shipped over 1,000 carloads, counting ten tons to a carload, of dried prunes alone from the San José depot. Should we have a full crop next year, we will ship 2,500 such carloads of that fruit from that depot. Colonel Hersey, a very intelligent fruit grower, makes a conservative estimate that from the trees now planted in this county we will produce annually over 200,000,000 pounds of dried prunes. Some idea of the enormous extent of that particular industry in this valley may be obtained when we remember that the annual consumption of prunes by the United States is only from 50,000,000 to 60,000,000 pounds, and has never yet reached 100,000,000 pounds, even in the years when they were very cheap. And yet, second only to our prune industry, is that of our apricots, our peaches, our pears, our cherries, and various other fruits.

I have said this much of our valley, not in vaunting praise, but that you may see that we are a community of fruit growers, and hence that you have come to a community of friends. In such a community, it goes without saying that you are more than welcome. We welcome you most heartily and unreservedly, and we mean every word of it. We go beyond that, and extend to you our most heartfelt gratitude for holding your convention here, where so many of us can profit by your wise deliberations. In conclusion, we assure you that nothing will give us more pleasure than to feel that you have enjoyed your stay while sojourning with us.

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### THE PRESIDENT'S ANNUAL ADDRESS.

By HON. ELLWOOD COOPER, of Santa Barbara

This is the Sixteenth State Fruit Growers' Convention, and the twelfth held under the auspices of the State Board of Horticulture. At the last convention, held at Marysville, one year ago, I was not present, for reasons beyond my control. It was a great deprivation and deeply regretted by me. These meetings form an important part of my life, and I must express to you my gratitude for the privilege of meeting you and feeling that we are friends united in our efforts to promote the best interests of horticulture. While our special purpose is to interchange ideas and discuss the fruit problem, we are developing other interests

and effecting results more important even than the successful culture of fruits. The harmony and unity of feeling and purpose always present, that have governed our deliberations, are creating a public sentiment, and on our maintaining the same unselfish interest in the general welfare will eventually become a controlling interest in State affairs.

In reviewing the proceedings of the last convention, we find an increasing and deeper interest manifested. It is very gratifying to the members of the State Board to feel that their efforts are appreciated. This encouragement will stimulate them to make greater exertions toward meeting the demands of fruit growers to the fullest extent.

It will be appropriate in this place to mention that we had hoped to have our Report for 1892 ready for distribution at this convention. We have succeeded in getting only a few partial copies, which are present merely to show the character of the work. By the middle of December or earlier, they will be ready for distribution. The report will cover from five hundred to six hundred pages. This volume is different from any of the previous reports. It contains two maps, which have been prepared with great care. It speaks of the geography, topography, and the climate of California, giving the horticultural history of the State, the progress, the adaptability, and the actual condition of all the fruits grown in every county in the State. This is a book for distribution to Eastern people who anticipate coming to California to make homes. The State Board of Examiners have thought so well of it that they have ordered 10,000 extra copies—in all 20,000—that our Board might distribute them broadcast throughout the East. Of the 10,000 for distribution in California, 2,000 copies will be required for the different departments of State, for members of the Legislature, and for the uses of the Board. The remaining 8,000 copies will be for distribution to the fruit growers in the fifty-four counties. I would suggest that the Horticultural Boards of the different counties send in their applications, with the lists of the fruit growers in their several districts who ought to have this work, in order that we may prorate the distribution so as to do equal justice to all parts of the State.

The Secretary of State has requested that the lithographic plates producing the maps be purchased and preserved, that said maps can be reproduced for other departments. I regret to state that we have not the money that can be applied to this purpose. Possibly we may get the parties to delay their destruction until some provision can be made. The Superintendent of State Printing has written us, under date of the 12th, that the report is stereotyped, so that it can be reproduced at any time.

The members of the convention will understand that our work is increasing and extending in every direction. The appropriation is inadequate to meet the necessities of progressive development.

I have from time to time on previous occasions called your attention to the questions that appeared to concern us most. At this meeting I will briefly mention some of the subjects for discussion presented in the programme, and refer you more particularly to the address of our Vice-President at the opening of our last convention, held one year ago, to be found on page 368 of Report for 1891. Better quarantine laws were therein recommended. The subject of canned fruits, false labels on worthless fruits, and a system of inspection, besides other important questions, were brought to the notice of the convention, all of which still concern our success.



Regarding the appropriation of \$5,000 for the purpose of searching out predaceous insects to destroy insect pests, I should like to say here that Mr. Albert Koebele has, to the best of his ability, performed this service, and with very encouraging results. His report will be presented to you.

It is my opinion that the beginning of the end has dawned, and that devastation by insects will soon be a thing of the past, as far as those insects are concerned that are now here and troubling us. If we are cautious and determined in not letting any new insects establish themselves, we will be saved from further spraying and expensive remedies. This method of counteracting the depredations of insect pests is new. It has not been practiced at any period in the world's history, and if we carry out the project to its full completion, the fruit growers of California will be credited with one of the wisest measures ever encouraged or instituted. Its importance will be lasting through all future civilization. No measure so strongly recommends itself to the intelligent legislators as this, and it is to be hoped that at the coming session such aid will be granted as will permit the State Board to carry out the plans they have projected, so that the final solution may be reached. Five thousand dollars per year for the next four years would be a sufficient sum to keep Mr. Albert Koebele constantly at work. I am confident that a parasite for every noxious insect will yet be found and colonized in California. It would save many millions to the fruit growers, would advance the prosperity of the State more than any other one thing, and would develop thought in other directions, because it deals with the economy of nature, and brings us in closer relations with the Deity. I recommend that a committee be appointed to urge this matter in the coming Legislature.

Before leaving this subject, I call your attention further to my address before the fruit growers at the convention held in Los Angeles, where mention was made of the enemy to the grasshopper. (See Report 1890, page 40.) There does not appear to be any doubt but that the insect *Bracon capitata* would prove an effectual remedy to the devastation caused by the raids of grasshoppers. It is our duty to search for and introduce this parasite. In an article written by Charles Naudin for the "Garden and Forest" (December, 1890, page 625), it is stated that the pigmy owl, known in France by the name *Cheveche*, is an effectual enemy to the excessive multiplication of the European sparrow; also that the great owl, *Stryx bubo*, is the special enemy of rabbits. We should procure these birds and introduce them into the San Joaquin Valley, where suitable houses could be built for them at a very slight expense. I would also suggest the introduction of wild cats, a most successful enemy to all kinds of rabbits. Local laws could be made to protect these animals while the country was being rid of the devastating pest known as the jack-rabbit.

The present methods for the disposal of our fruits are very imperfect, resulting in unsatisfactory results to the producers as well as to the consumers. They have not improved as was anticipated. We discussed this subject very fully at the Los Angeles convention held in November, 1885, and at every convention held since then. Now let us act. I beg to call your attention to the essay of David Lubin, read at the Marysville convention, to be found on page 418, Report of 1891, and the discussion following. In considering this subject, I suggest that the railroad question be eliminated. Let us deal with this branch entirely separate from every other subject that comes before the convention.

On previous occasions I have called attention to forest culture, a branch of our industries, and one that concerns the very existence of the human race. The starvation in Russia, so fresh in our memories and so alarming, a calamity so appalling, should cause us to think, and, if possible, arrest a similar danger that may occur here. A very interesting essay on this subject, by Abbot Kinney, is to be found on page 141 of Report of 1890. I also refer you to the "Garden and Forest" of April 6th, page 157, of August 24th, page 397, and of August 31st, page 417. You will pardon me for quoting from the latter as bearing directly upon the question of starvation in Russia:

"The regions of the mighty rivers the Don, the Volga, and the Dneiper were formerly fringed with wide-spreading forests along their whole upper and middle courses, which sheltered their sources and tributaries from evaporation throughout the year. These forests have now for the most part disappeared. Mile after mile the traveler sees nothing but low shrubs and melancholy stumps in unbroken succession. \* \* \* The city of Pottawa lies on the banks of the once noble Worskla. It was at its mouth that the Swedish army surrendered to Peter the Great. This stream, which fertilized a broad region, supporting a numerous population, exists no more, not temporarily run dry, but with all its springs exhausted, so that in future it may be stricken from the map. The Bitjug, another river in the Don region, the upper course has wholly disappeared, valley and bed are filled to the banks with sand and earth. As if by magic wide fertile lands are buried under the sands and whole villages desolated. \* \* \* The extension of the railways afforded an opportunity for extracting colossal fortunes from these forests. \* \* \* The Government and people of Russia had already been warned forty-two years ago and commanded to protect the forests, sow, plant forests, and protect them with rigorous laws. The Volga and the Don, and all the rivers of southern Russia, will be silted up and disappear unless the forests be protected. More fatal even than the drying up of the streams is the cessation of the spring and summer rains. This is the immediate cause of last year's harvest failure."

Now, my fellow citizens, will we permit this devastation to go on in our own country? I recommend the passage of resolutions urging the United States Congress to pass Senator Paddock's bill, "to provide for the establishment, protection, and administration of public forest reservations, and for other purposes."

I call your attention to the proceedings of a convention of olive growers, held in San Francisco on the 21st of July. A committee was appointed on legislation, to obtain, if possible, such amendments to the Pharmacy Act and to the Olive Oil Act as would secure the enforcement of these laws. I recommend that this convention ratify the appointment of this committee, or appoint a separate committee to act jointly with them. The names will be found on page 42 of the report of the proceedings.

The amended act of the vagrant law, as passed by the last Legislature (Statutes of 1891, page 130), does not provide any special law as to arrest, this part being left to the general law of criminal procedure, Chapter V, page 182, of "Codes and Statutes of California." This law has not been effective. It could not be expected that a farmer or fruit grower, especially in a busy time, could follow a vagrant ten, fifteen, or twenty miles to a police court to identify him and have him punished; nor, on the

other hand, that each farm or orchard should have a deputized officer clothed with the power to make arrests. A vagrant population tramping over the country without any visible means of support, begging from house to house, is a detriment to the farmer and fruit grower, as well as to every industrial pursuit, and it ought not to be permitted. The law should be so amended that the local officials in every district could be empowered and compelled to arrest every wanderer of this class. The peace, comfort, and happiness, especially of the rural population, demand it; and the best interests of the wanderers themselves, a no less important consideration, would be promoted by this means. I recommend the appointment of a committee to secure an amendment to this law that will effectually put a stop to this evil.

At the Marysville convention a committee was appointed with power to act as an advisory committee to the World's Fair State Commission (see clause third, page 414, of Report of 1891); also, under fourth clause, same page, the resolution in favor of a reissue of the State Board's reports, in a condensed form, from 1885 to date. I have no knowledge of what the committee has done toward the encouragement or the securing of a creditable fruit display, but I feel that we should take some action at this convention to impress upon the fruit growers the importance of making our greatest efforts on this occasion. The reissue of the State Board's reports, previously recommended, is desirable for several reasons: a number are wanted for reference in the schools; the increased number of fruit growers desire the information contained in them, but who cannot obtain copies, the entire issue being exhausted; and a number should be at hand for distribution at the Columbian Exposition. No work could reflect more credit upon the California fruit growers than such a book. If this Legislature act quickly, there is time to get ready a thousand copies for that occasion. It is as important as literature on any other subject, for it represents our intelligence, and as a horticultural work has not been equaled by any other State or any other country. The Legislature could prescribe the conditions of their distribution. The Superintendent of the Department of State Printing has given us the estimate of cost of 30,000 copies, the number we recommend to have printed, as follows: Paper, \$4,900; composition, \$2,400; presswork, \$2,000; binding, \$2,200; total, \$11,500. Handling expenses, boxes, drayage, and workmen, about 3 per cent, or an aggregate for the total number of 30,000 copies, \$15,000; lithographing would cost about \$5,500; compiling would cost \$2,500; making an estimated expense of \$23,000. A sufficient number could be turned over to the Superintendent of Public Instruction for the public schools, and, after presenting a few copies to each foreign Government represented at the Columbian Exposition, and a few copies to each State department, the remainder could be sold for the benefit of the State, at a price that would meet the entire expense. I recommend that a committee be appointed to have the matter brought before the Legislature.

Simon Sterne, one of the best writers on railway service, said: "Of all the factors that have contributed during this century to the growth of wealth, to the increase of material comfort, and to the diffusion of information and knowledge, the railway plays the most prominent part. It is not, however, an unmixed good. It causes cities to become overcrowded. It takes away the independence of the individual workman; it makes the handicraftsman part of a huge machine, and compels the



workman to give his time more and more to smaller and smaller parts of the whole operation necessary to produce a given result."

Every country which has allowed the railway to be built by private enterprise has fostered a class of unscrupulous operators, furnishing them the means of achieving great fortunes. Absence of governmental supervision in the stock capital of railways has caused the placing on the money markets of the world of a vast quantity of fictitious values not representing actual constructions in money value. At the very outset of railway development, Stephenson, who was as wise a statesman as he was an engineer, insisted that railways should be taken in hand and operated by the Government, claiming that from its nature and character it was a highway which would in time become more important than the ordinary road. In terse language he expressed, before a committee of Parliament, his opinion, that competition would not be the means of producing in this case, as it does in others, the cheapest and best results for the community, because, said he, where combination is possible, competition is excluded.

Mr. James Morrison, in a speech delivered before the British Parliament, in 1845, said, regarding the rates of toll, that he would determine the rate in every case by the sum at which the particular line of railway could now be constructed. The public are not bound to inquire what the line has really cost, but merely to ascertain the sum for which it could at the present time be constructed, and the railway proprietors ought to be compelled to carry the public and their goods for such fare as would yield a fair profit upon such outlay.

*In Belgium* all concessions for constructing railways are granted by the Minister of the Interior, subject to the ratification of the Chamber of Deputies and of the King. The expectant corporators offer a plan, giving the line of the route, estimates of its revenue, and the probable expense of the undertaking, together with a tariff of tolls for passengers and freight traffic. This is submitted to competent engineers, and all verifications of the calculated costs of the projectors are made at the expense of the latter. Then for a period varying from one to three months the whole plan is advertised. After these reports, a hearing is had, at which the engineering work, the guarantees for its execution, the rate of charges by the company, the time for which they may be demanded, and the time within which the work is to be commenced and finished, are specified. After all these questions have been settled, the whole matter is then submitted to the Chamber and Senate and the King, any one of whom can alter it before it becomes a law. All the main lines are owned and operated by the Government. In 1850 the Government owned 64 per cent and private individuals only 36 per cent of the roads. The Government may at any time, if a line becomes profitable, buy it up, as under the terms of every concession the road is subject to purchase by the State for the benefit of the commonwealth. The purchase price is the net receipts for the last seven years of the company's working, from which the receipts of two most profitable years are deducted. It is needless to state that this system resulted in giving to Belgium the best and in every way the most efficient network of railway service on the face of the globe.

*France.*—In France the Government advanced large sums of money to the railways upon the condition that at the end of ninety years all the lines should become State property, the State to take the rolling

stock at a low valuation. All the rates of charges, for both passengers and freight, are regulated with the utmost minuteness. At any time before the ninety years expire the Government can purchase the whole at a capitalization of an average of fifteen years' income, after disregarding the two worst years, and taking as the minimum figure of the capitalization the lowest year immediately preceding the purchase. Every tariff of charges must be submitted to the Government for the purpose of receiving its sanction, and a month's notice must be given of any proposed change. Every passenger time-table is submitted to the Government for approval. No one interested in the stock of the railway, or in its direction, is permitted to make any contracts with the railway for supplies.

*North Germany.*—All concessions are made by the Minister of Commerce. Since the formation of the German Empire, the separate States have agreed to concede to the Empire the power of expropriation, and the new lines are to be constructed under the Empire.

*Prussia.*—All tariffs, for both freight and passenger traffic, must be submitted to the Government, and receive its assent. At the close of the war with France, the iron chancellor, Bismarck, had determined that the railways should become the property of the State, so that, in 1882, 9,500 miles belonged to the State, 1,320 miles of private lines were under State management, and 2,400 miles under private management.

*Austria.*—This country followed the course of France by making concessions for a period of ninety years to the railways. Its system of supervision, as to the tariff of both passenger and freight traffic, is complete.

*Italy* possesses a large majority of the mileage of rail within its territory.

*Switzerland* has an extremely effectual system of supervising the tariff of charges, which must exist on all her roads. In all these countries, therefore, the railway has never been regarded wholly as a matter of private enterprise.

An investigating committee appointed in New York State in 1879 made an exhaustive report. In alluding to watered stock they referred to the fact that it was proved before them that \$40,000,000 was probably the whole value of the property and equipment of the Erie Railway Company, and that \$25,000,000 more would cover the additional value of the road as represented by stock and bonds and interests in other corporations, while it was capitalized at about \$155,000,000. The construction account covered, in 1873, an item of "legal expenses" of \$891,000. The watering of the stock was estimated by the committee to be not less than \$70,000,000. From 1868 to 1870, by the consolidation of the New York Central and Hudson River railroads, \$44,000,000 was added to the combined capital of both. The fictitious capitalization of the railroads in the United States is a very difficult problem to deal with. There is no question but that the system is entirely vicious and caused by the public treating them as private enterprises instead of public ones. The aggregate capital of all the railways reaches something like \$8,000,000,000, or eight times the public debt; a considerable portion is in the hands or largely under the control of less than one hundred men. In any contest, therefore, between the Government and the railways, it is clear, that so far as mere pecuniary interests are concerned, the railway enterprises largely preponderate. On account of the

concentration of this great railway power in comparatively few hands, the extent to which they can corrupt the commonwealth is practically limited only by their will.

We have heard also considerable discussion about the burden of taxation in the last political contest. The greater portion of the time of two congressional sessions was taken up in discussing this subject; one, with the Mills Tariff Bill, the other with the McKinley Tariff Bill; yet, the whole amount of revenue resulting from the present tariff is not more than one half the tax levied on railroad transportation; and while the people throughout the country are conversant with all the arguments in support of one or the other methods, and have a voice in determining the adoption of the one or the other, they have no knowledge nor voice in the greater and more burdensome railroad taxation. There has been in New York City a small number of men, any one of whom could invite the others privately to his house, where by common agreement they could secretly raise the railroad tax 10 per cent, secretly telegraph it throughout the country, without the knowledge of any one excepting the various railroad companies, have it enforced and levied upon the industries of the country. There is no government, either republican or autocratic, on the face of the globe that could accept this evil in times of peace without bringing on a revolution. No community can safely pursue its course of happiness and well-being before such an insidious power. The citizens of the United States are therefore called upon to meet this question. There are two ways: one by civil laws, the other by revolution. Experience has proved that competing lines do not give relief, but, on the contrary, multiply the evils. We have, for example, five cross continent railways. Two could more than do all the work. We have therefore, practically speaking, more than double the tax on the industries by reason of the superfluous systems. No parallel lines running between two points should be permitted, where an existing line can do the service. The Government should own all the main lines, or at least have the control of them.

A franchise to a common carrier is not a local or State question. It should be limited entirely to the government of the whole people. Every citizen in the country who uses a common carrier, and all do, should have a voice in its creation and in its management. A citizen residing in Maine or Minnesota may use the California railroads to a greater extent than even Californians. It is a question belonging to Government, just as much as the national defense or the post office. Therefore, no franchise to a common carrier, at least on a main line of travel, should be granted except by the Government, and it should be guarded by such conditions that would protect the rights of every citizen, be for the public good, and be controlled by the whole people.

Monopoly breeds monopoly, hence the formation of trusts and syndicates; and like their parent model, they have their foundation in fraud, by fictitious capitalization taxing the public to reap a reasonable interest on fictitious values, furthermore acquiring power to govern prices, causing lower prices to the producers of the raw material, higher prices to the consumers of manufactured goods, and larger profits and accumulations to themselves. The machinery of the State government is amply sufficient for dealing with this evil. By amending our corporate laws, no incorporation should be granted, unless restricted to the extent that it could not transact business on a fictitious valuation. The purposes



of the projectors should be set out in their petition of application as to the extent of their business, with a limit to the profits to be derived therefrom; and unless it could be shown that by such unity of operators economy would accrue to the general public, the petition should not be granted. The books of the corporation, and the business management, should be open to the inspection of legalized State authority.

It will not be many years before our fruit shipments will be ten times as great as the present. The two questions of all-absorbing interest therefore are, first, how to dispose of the fruit, and second the rates of transportation. The present method of disposing of the fruits will not answer, because the commission merchants in the various localities have no direct interest in the prosperity of the fruit growers. Their interest is a selfish one, based upon the probable commissions they will receive for the time being, and not upon the ultimate result, which must affect every possible consumer seeking markets everywhere, that there may be no over-supplies nor waste. An employed interest directed by the fruit growers can alone secure this. We must sell our own fruits, otherwise serious losses can arise at any time from improper distribution. Rates of transportation must be fixed upon the basis as indicated in what I have outlined; that is, on the actual cost of transportation, with a reasonable interest on the capital invested; that is, on the actual cost of a system adequate to the demands, capable of transporting the fruits without delays, and not upon the fictitious valuations of the various superfluous systems.

Recess.

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## XII.

### AFTERNOON SESSION.

President COOPER in the chair.

#### APPOINTMENT OF COMMITTEES.

The President announced the appointment of the following committees:

*On Resolutions.*—W. H. Aiken, E. W. Maslin, Frank A. Kimball, H. A. Brainard, R. C. Kells.

*On Freight Rates.*—L. W. Buck, L. Archer, John Rock, C. T. Settle, C. E. Reed.

*On Legislation.*—S. F. Leib, N. P. Chipman, William Johnston, Frank H. Buck, W. H. Aiken.

#### CO-OPERATION AMONG FRUIT GROWERS.

By A. L. BANCROFT, of San Francisco.

The basis of this paper is the plan for a State Dried Fruit Exchange, which has already been presented to the fruit growers of the State. More study has been put upon the subject and a few modifications have been made.

We hope at this time to advance further toward obtaining the desired results of effecting an organization than we have as yet done, and to leave matters in such a shape that work will proceed without interrup-

tion until either the organization is consummated or it is clearly demonstrated that it cannot be accomplished.

No plan has been presented as an improvement upon the one herein outlined, or as a substitute for it. If nothing is ready now to be offered, is it not in order to consider whether or not this one has sufficient merit to justify an earnest effort to establish it?

#### CALIFORNIA DRIED FRUIT EXCHANGE.

An organization in the interest of the producer.

*The object* is to furnish a medium through which to market California's product of dried fruit, figs, raisins, almonds, nuts, etc.

To shift the market places and concentrate the marketing at San Francisco in the place of having it sold at different places within the State, and consigned for sale to places outside of the State.

To do away with the competition of one county or section of the State with those of another, and also with the competition between individuals of the same locality.

To assist members in buying supplies of all kinds—lye, sulphur, trays, ladders, implements, etc.

To establish best methods of packing, shipping, etc.—and perhaps grades and brands, or marks, to indicate them.

To gather and disseminate valuable information among the fruit growers.

*Board of Directors.*—To have a Board of seven Directors, which shall be selected, as far as practicable, so as to have each prominent fruit-producing section of the State represented.

Compensation to each member of the Board, a fee of \$20 for each regular meeting attended, if he is strictly on time. Also mileage of 5 cents a mile each way from the county and return, for each regular or special meeting attended, if strictly on time. No additional fee for attendance at special meetings. Their compensation to be paid only out of the net earnings or surplus of the Exchange.

To have the management and control of the affairs of the Exchange; to fix salaries of all, except of themselves; to employ all of the assistants required, and to discharge them at their pleasure.

To establish uniform grades of dried fruit, etc.

To serve seven years, and to go out of office one at a time. The length of the first term to be decided by lot. Vacancies in the Board to be filled, until the first election, by the Board itself.

Regular monthly meetings. Special meetings on call of President or Manager.

The Board of Directors should be elected by ballot by the selling members—each \$100 of sales made during the preceding season to be entitled to one vote. The election should be held April 1st, of each year.

The first Board shall be elected by those who pledge themselves to sell their product through the Exchange the following season or year—1893. Each producer to have one vote.

The Board of Directors should elect the officers: President, Vice-President, Executive Committee, Manager, and assistants. The management of the Exchange should fall upon the Executive Committee, it being all the time subordinate to the Board of Directors.

*Executive Committee.*—To have an Executive Committee of three, to be elected by the Board of Directors from among its members. Weekly meetings from June 15th for six months, and bi-weekly meetings for the remaining six months, or say forty meetings in the course of the year; compensation, \$20 to each member for each meeting attended, and mileage, if strictly on time. A record to be kept of their transactions by the Secretary. Where the members are not unanimous upon any point, it may be dropped or referred to the Board of Directors for action.

A *Manager*, to devote his entire business time to the interests of the Exchange; to be Secretary and ex officio member of both Board of Directors and Executive Committee, but to have no vote in either body; compensation, \$200 per month, to be paid out of net surplus or earnings; two assistants—one at \$50 per month and one at \$25.

*The Members* of the Exchange to be of two classes—selling members and buying members. The selling members to pay a fee for the season of \$5, the buying members to pay a fee for the season of \$10. The Exchange to locate in rooms as near the State Board of Horticulture as practicable; rent probably about \$75 per month.

The Exchange to receive samples of dried fruits, etc., grade them, and to sell by sample, charging to the seller and buyer each a commission of  $1\frac{1}{2}$  per cent, making 3 per cent in all to the Exchange. The commissions, or a part of them, to perhaps be deposited with the Exchange in advance, or the seller to be responsible for all, he to collect from the buyer at the time of sale.

The Exchange to effect sales by correspondence as well as in their rooms, charging the same commissions; the seller to furnish samples and the purchaser to pay transportation on them.

No samples to be accepted by the Exchange except from parties who contract to sell their entire product for the entire season through the Exchange. No one to be admitted as a seller for any season if he shall have made any sales previous to applying for membership. No dealer in dried fruits to be admitted as a selling member.

The Exchange to assume no responsibility as to goods agreeing with samples; that must be arranged for between buyer and seller. No goods to be consigned by the Exchange. The selling prices to be determined from time to time by the Executive Committee.

The "lots" of samples to be numbered; the buyer to pay his  $1\frac{1}{2}$  per cent commission before receiving a card or certificate of the Exchange, showing that he has bought the "lot," and is given the name and address of the seller.

Should the goods not agree with the sample, or the buyer be not satisfied with them and will not take them, the Exchange to refund the commission paid.

The seller to pay to the Exchange his  $1\frac{1}{2}$  per cent as soon as the sale is consummated.

The Exchange to issue bulletins to the seller weekly from July 1st to January 1st, and bi-weekly from January 1st to July 1st, giving statistics of sales made, goods unsold, etc., and market rates of dried fruits, etc., all over the world. The bulletins to be mailed in sealed envelopes. Accompanying the bulletins once a month shall be a blank form of report and ballot—on a postal card—perhaps to be numbered for the seller to fill out, showing the quantity of dried fruit he may have on hand and the prices at which he is in favor of offering it, but the prices



at which it is to be held are to be finally determined by the Executive Committee.

Lots of goods offered shall be listed at the Exchange in the order accepted, and shall be offered to the buying members in the same order. Perhaps make a separate list for each variety of fruit.

If goods remain with the Exchange unsold for a period of six months, the selling member is to be allowed to apply for and receive permission to offer them at private sale at any price he may desire, and if so sold the Exchange shall be notified, but the Exchange shall not be entitled to any commission upon them.

The Exchange to make the most favorable arrangements possible for the storage of goods while awaiting a purchaser, and also for the obtaining of loans upon them.

At the members' meetings only selling members shall be present or be represented by proxy. Buying members shall have no part in the management of the affairs of the Exchange. Buying members shall not hold proxies of selling members.

Proxies may be voted at members' meetings, but no person shall hold or vote at one time more proxies than those of one member.

The Exchange should organize at once and commence preparations. Applications for selling memberships to be solicited at once, conditioned upon business amounting to an estimated amount of not less than \$250,000 for the season, to be obtained before they shall be considered binding. Requests should be made in each notice published that producers send their names and address to the Exchange, in order that circular matter may be sent to them. Advertisements to the same end should be inserted in the trade papers.

#### ESTIMATE OF RECEIPTS AND EXPENDITURES.

##### *Receipts.*

Commission on \$250,000 sales, at 3 per cent.....	\$7,500 00
Fees from 500 selling members, at \$5 .....	2,500 00
Fees from 25 buying members, at \$10 .....	250 00
Total .....	<u>\$10,250 00</u>

##### *Expenditures.*

Board of Directors—twelve meetings, at \$100 .....	\$1,200 00
Executive Committee—forty meetings, at \$60 .....	2,400 00
Manager and Secretary .....	2,400 00
Assistants .....	900 00
Rent .....	900 00
Stationery, printing, postage, fuel, lights, etc. ....	2,000 00
Sundries, extras or surplus .....	450 00
Total .....	<u>\$10,250 00</u>

The \$250,000 worth of goods to be sold by the Exchange would be about one eighth or one tenth of the apricots, peaches, and prunes alone, to say nothing whatever of figs, raisins, grapes, almonds, nuts, etc. How much business it would be reasonable to expect might be done by the Exchange the first year, it would be difficult to say. If the sales were materially in excess of the amount named, the commission to the selling members should be reduced, or be cut off entirely, or they should have a drawback at the end of the year, which would materially reduce or wipe them out. The commission to the buying members should not be reduced. Upon the basis of *five* Directors, the estimated expenses were \$10,250, as above. With seven Directors, and a more pushing policy, say that the

expenses should reach \$15,000, \$18,000, or even \$20,000 a year, the 1½ per cent of the buying members alone on a business of \$1,500,000 would more than cover it all.

Subscriptions should be started at once to a fund to guarantee the expenses of attempting an organization. If the attempt is successful, the expenses would be met in the ordinary way; if not successful, they would be divided pro rata among the subscribers.

If an enterprise of this kind bids fair to succeed, there will be danger that the middlemen will try to find some way to strangle it, in order to protect their own interests. The possibilities of such an attempt resulting successfully should be very carefully guarded.

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REFERRED TO COMMITTEE.

N. W. MOTHERAL moved that Mr. Bancroft's paper be referred to a committee of three, to report thereon to this convention. Carried.

The President appointed as such committee, N. W. Motheral, G. M. Gray, and E. F. Adams.

RESOLUTION.

WM. JOHNSTON offered the following resolution:

*Resolved*, That the address of the President be referred to a special committee of three, to be appointed by the Vice-President, and that the report of said committee shall embrace all the resolutions embraced in the address.

Adopted.

COL. PHILO E. HERSEY in the chair.

COLONEL HERSEY appointed Wm. Johnston, of Sacramento; Frank A. Kimball, of National City; and E. W. Maslin, of San Francisco.

THE LATE MATTHEW COOKE.

MR. JOHNSTON asked consent to present at this time a report of the committee heretofore appointed to erect a monument to Matthew Cooke.

*Mr. President and Members of the Convention:*

Your committee, to whom was referred the matter of providing means and erecting a suitable monument to the late Matthew Cooke as a mark of appreciation by the fruit growers of California, beg leave to make the following report: We have discharged the duty imposed upon us to the best of our ability by erecting a granite monument, the base of which is 6 feet by 4 feet and 7 feet 6 inches high, at a cost of \$565. We have collected \$462 in cash. Carlaw Brothers, the contractors, donate \$50, making total contributions \$512, leaving a deficiency of \$53, \$38 of which is due the committee and \$15 due the contractors.

Your committee desire the convention to contribute this amount of \$53 and discharge the committee.

WILLIAM JOHNSTON.  
R. C. KELLIS.  
WILLIAM MCKINLEY.

The report was adopted, and the members present contributed the amount asked by the committee.

On motion, the committee was tendered a vote of thanks.

## NICARAGUA CANAL.

By EDWARD BERWICK, of Monterey.

Mr. President: I do not think that the farmers are sufficiently impressed with the importance of the Nicaragua Canal. At the present time our dried fruit must either go by car to the East or must go by the long sea route; the latter is a four months' journey, and if the canal were built it would be a four weeks' journey. Now our fruit must go over 7,000 miles of what they call the torrid zone—tropical heat; if that canal were built 2,000 miles of torrid zone would be all our fruit growers need to fight against. Now, there are two proposals before the United States regarding that canal: One is to have the great American nation build and own it and run it for the benefit of the American people, and the other is to have a company borrow the money of the American people to build that canal and charge such rates as they see fit. The cost of the canal, if built by the Government, will be about \$65,000,000. The company want to borrow from the Government \$100,000,000 and they are willing to allow the Government a minority in the company and they will boss the job. They say the American people cannot build that canal for various reasons: a treaty fifty years old, called the "Clayton-Bulwer Treaty," they say, prohibits us from having any interest, you might say, in Central America. That treaty was made with John Bull. Now, gentlemen, the conditions alter in fifty years, and I think you will find that John Bull has altered, too. It would be a source of gratification to John Bull to have that canal built; he has quite a few ships on the ocean, and he wants to get these ships to and fro as swiftly as he can. We are told there are other reasons to forbid our building that canal, but I want you to think about it—whether what six can do, the whole nation cannot do. I believe the whole nation is bigger and stronger and can do more than those six men, I don't care who they are, and I do hope that this matter will be fully considered.

MR. BERWICK then introduced a set of resolutions, which were referred to the Committee on Resolutions.

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TRANSPORTATION AND MARKETING OF FRUIT.

## RESOLUTIONS.

MR. BERWICK offered resolutions on the subject of transportation, which were referred to the Committee on Resolutions.

W. H. AIKEN, of Wrights: This question of transportation is one of the great questions of the day. A number of us some years ago organized the Fruit Union, and I believe that that corporation has done great good in the way of transporting the fruits of California to a profitable market. It was the intention of that organization to distribute widely and evenly the fruits of California, and to gather into its active support the fruit growers of the State, and it was supposed for a year or two that we had the active and generous support of them all; but unfortunately some of the largest growers decided to act independently of the Fruit Union, and in many instances the fruit of these large growers was



brought in actual competition in the same market with that of the Fruit Union. Resulting from this were low prices and some discouragement; but as years rolled on our prices have improved, and the work of the Fruit Union has become better understood. The difficulty is now that the Fruit Union can handle carloads and trainloads of fruit and carry them to the great distributing centers of the country, but as to the distribution of the fruit to the smaller cities and villages of our country, it has in a measure not accomplished what reasonably might be desired, and now comes the necessity of more general distribution. We will have to look to some other organization than the railroad or the express company, or even the Fruit Union. To my mind another organization might be formed, say of the fruit producers of the State of California, possibly under the name of the "Fruit Express Company," becoming a great express company for fruit, the same as Wells, Fargo & Co. and other companies are for articles generally. It is believed that in such an enterprise there is a fortune to the grower by bringing his produce directly to the door of the consumer at a reasonable charge. As it is said California will soon produce so much fruit that, unless we have the markets not only of the United States but of the great centers of Europe, there may be a glut in the fruit production of this State; but I am a firm believer that, as we have only reached about five millions of people with our fruit so far, we can reach the sixty millions of consumers in the United States, and they will take all the fruit that can be raised upon the Pacific Coast; in other words, I believe that the fruit consumption of the United States will keep pace with the fruit production. I know I have often said in relation to the prune industry, that, however great the production of the prune may be, it will be found that the consumption will keep pace with it, and that there never can be a glut of the fruit product of the State of California. Now comes the serious question, How transport the fruit to the consumer? The railroad, no doubt, would contract to carry any express fruit car through the East, and fruits could be sent from California as now, in trains, and distributed by the express fruit car system through the United States, and this would solve the difficulty, which would make us independent of the railroad and independent of the express companies as now organized in this country.

L. W. BUCK: No one would be more pleased to see these measures carried out, as these gentlemen think they might be, than I, and I presume that the railroad company would likely favor such a project, but if they favor it as they are figuring now, it would be because they would get a local rate from each point that the car stopped at. You cannot start a car at San José, running it through, and open that car at points between here and Sacramento to put in or take out freight, unless you pay the local rate from point to point. Whether that would or would not pertain to the railroads East, it certainly is carried out in this State to the letter. I, as manager of the California Fruit Union, have paid in many instances as high as \$100 for loading freight in one, two, or three places to be forwarded East; that is, in excess of the regular rates from the first starting point to the point of destination.

A. BLOCK: Mr. President, at the last meeting of this convention, held in Marysville, a resolution was passed appointing a committee to ask the railroad company for a reduction of rates. The committee went to work and an effort was made to get the reduction—a strong effort—and

something was promised, and when it came to headquarters the Southern Pacific Company said, "No, we cannot reduce; we will not reduce, but we will give you better time; we will give you five days between here and Chicago." The fruit growers accepted that with pleasure. Had they done it, when the convention met I should have introduced a resolution thanking them for that concession. We felt thankful; every newspaper in the State, and particularly those subsidized by them, lauded them, spoke favorably of them—how thankful we ought to be. How thankful we would be were their promises kept. For about four weeks, when there was but little shipping done, they very nearly kept that promise. They didn't ship in five days to Chicago, but they shipped in about six days from Sacramento, and that was a benefit to us. But when we commenced shipping from this town, within a week from that time they took from five and six days to ten, twelve, thirteen, fourteen, fifteen, and as many as eighteen days. These are simple facts. Now, Mr. President, we have quite a number of men here that live in San José, and take a great deal of interest in this section. How many of them are aware that the Southern Pacific Company receives our fruit from here to go on the train at Sacramento, and consumes thirty-two hours between these two points? At five o'clock I have my cars ready to leave San José to reach Sacramento, and leave there to-morrow at 12 o'clock at night, and that is thirty-one hours. At my solicitation, our friend Mr. Buck and Mr. Anderson went to see the officials of the railroad company at San Francisco. They were very much surprised. "It was all wrong and it would be corrected." That is what they said. Well, they didn't. Within a week after that time we got notice that we must have our cars ready an hour sooner, because they had got so much fruit to ship from here that they hadn't time to weigh it, and we must give them an hour extra; and then add ten to fourteen days more on the way, and my fruit was there rotting, for which they got full pay and I got nothing. Now, you are proposing to see what the railroad company will do. I have done a good deal of missionary work, and, like so many other poor missionaries, the railroad company got my flesh—cannibals get it in other cases. Now, I state facts, and I challenge contradiction.

MR. MASLIN: There is no doubt in the world that the railroad company did not fulfill their contract with the people, but something can be done; and as I look back upon the last fifteen years at the convocations of fruit men, I have seen a certain element who say it cannot be done. I was present when the fruit growers talked about the Fruit Union, and they said it could not be done, but such men as Mr. Buck and other energetic men like him, have pushed the Fruit Union on to a successful organization. We know how the majority of fruit men in this State said that the auction plan could not be carried on, and when we heard the figures, and the statistics, and the arguments, it seemed impossible that we could auction our fruit in New York or in Chicago; but it has been done, and it always will be done in that way, and it only wants certain intelligent men to get together to talk it over, and they will get a plan which can be carried out. Now, the very plan suggested to-day in reference to this organization, would take these companies out of the control of the railroad, and they would have the right of track and the management of its cars and its train to carry their own fruit to the places designated. I am not practically acquainted with the system; I am not

able to tell you how it can be done, but do not let us stand by and say that it cannot be done; let us try among ourselves to form some plan, negotiate with the railroad company, have a resolution passed and a committee appointed to get up a plan and submit it to the railroad people. I bring these things before you to call your attention to the facts that stare us in the face: that we will raise more fruit in the next five years than we can find a place to carry it to, and we cannot expect the railroad company to take care of it or to find distributing points for us.

MR. BUCK: Myself and quite a number of others went to San Diego last spring to meet the Transcontinental Association. We asked for certain favors: One was a schedule-time freight train, to haul our fruit. This they finally agreed to give us; they finally agreed to give us a time of one hundred and twenty hours from Sacramento to Chicago and equivalent points. As my friend, Mr. Block, has said, up to some time in July there were very few occasions that they did not give us about the promised time. After that, when shipments were heavier, according to their own admissions to me, they were unable to do it, and they failed in doing it, or anywhere near the five days' time. As Mr. Block has said, they ran up to even as high as fifteen days, and the general time they took during the heaviest shipments was from seven to ten days. I waited upon the railroad company, and urged on them the utmost necessity of better time, and they virtually admitted to me that they could not possibly do it this season; the number of cars of fruit had been so much in excess of what they received in other years, that they had not calculated for it, and could not make it. Now, what we want is to bring a pressure upon the railroad company to induce them to so fix their motive power that they can handle the trains of fruit from Sacramento, be they many or be they few. I believe that the railroad company can, and I hope that they will increase it, giving us the same service with heavy shipments that they did early in the past season with lighter. All of the early shipments of the season paid well, I don't care where they were from. I was in the East myself during June, and saw the fruit unloaded and sold in Philadelphia, New York, Boston, Chicago, Minneapolis, St. Paul, and Omaha, and almost without exception in fine condition—very few cars had a few lines off in condition, but generally fine.

F. A. KIMBALL: I would like to say in regard to the statement of Mr. Block. In conversation with Mr. Huntington during this time, he assured me that it was utterly impossible for the railroad company to carry out its agreement with the fruit growers; that there were not cars sufficient, as they could not be returned in time to comply with their contract, and I think he said that cars enough had been ordered for the future—for next season—to permit him entirely to carry out the time schedule agreed upon, and possibly to lessen that time. I further asked him in regard to the lowering of rates. He said it would be the policy of the company to give lower rates just as fast as circumstances would arise which would permit the company to lower them. I asked him how low it could ultimately be expected that the railroad company would come without coercion. He did not give me a direct answer. I told him I thought we would live to see the day when a carload of fruit would be carried into Chicago for \$50. He asked me my basis of reasoning, which I told him, and his answer was, "It was simply a question of the quantity of fruit that you will deliver."



MR. BERWICK: Get your Nicaragua Canal started; get two or three Government railways across, and there will be no dropsy in California fruit.

MR. BLOWERS: While East two years ago with "California on Wheels," I took the privilege of interviewing the fruit dealers on a little line running between Sioux City and Davenport, and found they would each of them take their pro rata of a carload each day, and that there would have been at that time no difficulty of disposing of one carload daily at those points on that little short line.

MR. COOPER: I would like to state to the convention that I have had a little experience in shipping, and found no difficulty whatever in having the car partly unloaded on the Missouri River and the balance carried on to its destination. The railroad companies between the Missouri River and any point East have granted that privilege. With regard to the rates of freight, they have increased from 10 to 15 per cent over what they were two or three years ago.

MR. KIMBALL: I am reminded that the rates have been reduced from \$1,250 down to \$165. I remember well the reduction of \$1,250 to \$1,000, and when Mr. Crocker laughed in my face, and said I never would live to see the day when a car of fruit would be carried across the continent for less than \$1,000; but I have lived to see them bidding for fruit in San Diego County at \$165.

MR. MASLIN moved that the Chair appoint a committee to consider the question of a larger and wider distribution of fruit on the plan laid down in an address of Mr. Mills, published in several papers.

Carried.

The President appointed on said committee E. W. Maslin, Leonard Coates, J. H. Flickinger, A. Block, and B. F. Walton.

Adjourned till to-morrow morning at 9 o'clock.

## XIII.

## TRANSACTIONS OF THE SECOND DAY.

WEDNESDAY, November 16, 1892.

Convention called to order at 9 o'clock A. M.  
President COOPER in the chair.

## REPORT OF COMMITTEE.

E. F. ADAMS presented the report of the committee appointed to consider the paper presented by A. L. Bancroft, on Fruit Marketing, as follows:

*Mr. President and Gentlemen of the Convention:*

Your committee to whom was referred the paper of A. L. Bancroft, relating to the formation of a State Dried Fruit Exchange, have had the same under consideration, and beg leave to report as follows: The thanks of the convention are due to Mr. Bancroft for the thought and labor which have resulted in the carefully detailed outline of the plan submitted, and while we find ourselves unable to entirely agree with him as to the method to be pursued, we do most cordially unite with him in saying that a State organization of the dried fruit interest should be formed, conducted by competent men, paid to attend to their duties.

The points upon which your committee are unable to agree with Mr. Bancroft are as follows:

*First*—The plan of Mr. Bancroft contemplates that each grower shall contract to place his entire product for the season at the disposal of the Exchange, to be sold when, and at such prices as the Exchange may determine, or find feasible. Your committee do not believe that any considerable number of growers can be found who will make such engagement. We know that large numbers are compelled to realize on their output very promptly, and would not be able to make such contract. The Exchange does not propose any definite plan for assisting such growers by advances, nor would any such action be possible while the growers retained control of their fruit; this the plan proposes that they should do, and, in fact, they would have to retain control of it, unless the Exchange should provide warehouses, for which there is to be no money. It might be best that growers should put the control of their product into the hands of the ablest and wisest among them, but we are sure they will not do it, and we cannot recommend an effort to attain the impossible.

*Second*—Mr. Bancroft's plan contemplates the shifting of the market places from the vicinity of the various terminal railroad points, where the products now change hands, and concentrating all transactions in San Francisco. Your committee believe that this would immediately cause powerful and bitter antagonism in every locality now enjoying this trade, in the face of which the Exchange would be entirely helpless. No locality will surrender any portion of its business without a fight. It is not proposed to remove the fruit itself to San Francisco, which, of course, would be foolish, as involving useless local freight and more expensive storage, and we believe that no power on earth can prevent the bulk of the transactions from taking place where the bulk of the fruit is; buyers will not buy by sample when they can see the fruit in bulk. If the concentration of this business at San Francisco had been commercially economical, it would have long since been established there. We shall have enough to do in securing the reforms which we desire without attempting to make unnecessary changes in the natural channels of trade.

In view of these conclusions which we have reached, and after further consideration which we have given the subject, your committee report that in their opinion the end sought by Mr. Bancroft can be much more certainly reached by local associations at the important shipping centers, cooperating through a central Exchange, with such powers and duties as the local Exchange, when organized, shall find it possible and expedient to commit to it.

In seeking to outline some definite plan for such associations to report for the consideration of the convention, the attention of your committee has been called to the work of the Santa Clara County Fruit Exchange, which was incorporated last June and is now actively engaged in preparing for the business of 1893.

The history of this organization is properly this: Some time in April or May of this year, some twenty or thirty representative men of this county united in a call for a con-

vention of all interested in the fruit industry to be held in this hall, to consider how far they could cooperate in marketing fruit. The resulting meeting was large and enthusiastic, and was followed by others, the outcome of which was the organization and incorporation of the Santa Clara County Fruit Exchange, with Col. Philo Hersey as President; Edward F. Adams, Vice-President and Manager; W. H. Wright, Secretary, with a Board of nine Directors, a majority of whom, by the by-laws, must have larger interests as growers than as driers or canners. Growers, driers, and canners alone are eligible as stockholders, and no one can own stock in excess of \$1,000.

This corporation is empowered, under its articles, to take the green fruit as it comes from the tree, and do everything needful to be done for it, until it reaches the consumer. The original expectation was that it should take the fruit green, when desired, dry, pack, and sell it in carload lots to any purchaser who appeared, charging for such services the actual expense thereof—interest on the necessary capital. The idea of drying, however, was soon abandoned, or at least postponed, as it was believed that this work could be more economically done by the cooperation of small growers securing drying-grounds and plant in the midst of their orchards, leaving to the Exchange only the duty of marketing and grading, and otherwise preparing for the market the dried product of those who desired it.

The capital required is the sum necessary to buy a lot, build and equip a warehouse, and a small working capital besides. For advances on fruit, which will be made if desired, it is deemed best to borrow as required, as it is not economical to raise capital, to be idle eight months, for the sake of using it four months.

The plan of operations, as it now exists in the minds of the Directors, consists of two entirely separate and distinct functions:

- I. A sales-room in the business center, rented for the season, in charge of a paid employé, open to buyers and sellers, whether stockholders or not, upon season tickets sold at a rate to cover expenses. In this room the Exchange will offer what fruit it has to sell, and all others, being ticket-holders, can meet there, buying from the Exchange or each other, in the manner common in other produce exchanges.

- II. A warehouse, with grading and boxing machinery, to prepare the fruit of small growers for the market. The business of the warehouse will be conducted on the plan of doing for each stockholder whatever he may deem profitable to have done by the Exchange and nothing more, the Directors believing that if they do the business wisely and profitably all will desire to share their advantages, while if they cannot so transact the business it is better that they should not be intrusted with it. They wish for no waste of material owned or the markets established by any of the stockholders, but rather to maintain all that has been thus gained, and supply the same or better advantages to the smaller grower.

The following have been suggested as the principal rules which will govern the business, and most of them are involved in resolutions passed at various times by the Directors, but they have never been actually adopted in due form, and on one or two points they touch matters not yet considered by the Directors, but they indicate quite closely the present opinion among them:

1. Separate charges shall be made for each class of service, to cover the possible cost thereof, including interest on paid-up capital and insurance, and any excess shall be returned to the proper person when the actual average cost shall be ascertained at the close of the season. All fruit received shall be charged with insurance.

2. In addition to insurance the following are the services which the Exchange shall perform and for which separate charges shall be made: Storing, grading, inspecting, dipping, boxing, selling.

3. Any stockholder may have any fruit inspected, with or without any one or more of the above services, as he may order. No service shall be given except upon the written order of the owner, and no service shall be charged unless actually ordered and rendered. No fruit shall be handled by the Exchange or sold under its brand unless inspected.

4. All prunes received, when graded, shall be binned together, and transferable warehouse receipts given therefor, less — per cent to cover shrinkage. When all receipts shall have been honored any excess shall be sold for account of the Exchange and the proceeds divided, pro rata, among the consignors. All other fruits, so far as possible, shall be treated in the same manner. Fruit insufficiently dried shall not be receipted for until in proper condition. Inferior fruit, at the option of the Exchange, shall be kept in original sacks and sold only by sample. Any fruit, at the owner's option, may be handled in the same manner, subject to charge for any additional expense.

5. Advances, when desired, shall be made by the Exchange on all fruit subject to its control, at current rates of interest, up to the limit of sound banking, and fruit so pledged may continue subject to sale by the Exchange, the owner, or any agent, at the owner's option.

6. The Exchange shall guarantee sellers under its inspection against all claims for rebate.

7. All sales by the Exchange shall be for spot cash f. o. b. San José. In case of complaint by non-resident buyers in regard to weight and quality the same shall be promptly arbitrated, and if sustained the rebate adjudged shall be promptly paid by the Exchange.

The above, as before stated, indicates about what is proposed. The plan of inspection and guaranty against rebate would require an inspector's fee to be sufficiently above the actual cost of inspection to cover insurance against occasional inevitable errors of inspector. It should be added that the plan of inspection has not yet been worked out, but it must be based on exact definitions of what the Exchange means by "standard,"



"extra," and other brands of the different fruits. The Directors have gone far enough with it to convince them that such definitions are possible.

It will be noted that the Exchange requires its brand to be placed on all packages. It is intended that the inspector's label shall be so attached to the package as to be destroyed in opening. The Exchange brand is not to be to the exclusion of private brands, which it is desired to have also appear on each package.

The expectation of success is based on the belief that wise and prudent management will secure it, and upon the plan of uniting growers, driers, and buyers in an effort to secure the utmost economy in all movements and manipulations of the fruit for the purpose of reducing cost. The Exchange expects to save some commissions, but not all.

The relations of such an Exchange to a State Exchange might be indicated by the following resolution, adopted by the Santa Clara Exchange, and which expresses the opinion of that body:

"*Resolved*, That it be announced as the policy of the Exchange to induce the formation of Exchanges similar to our own in all prominent fruit districts of the State; and that when such Exchanges shall be formed, we will favor the formation of a State Association of Exchanges, the Directors of which shall be selected from the local directories, and whose functions shall be the gathering and distribution of information, the opening of new markets, the care of our exhibits at important industrial expositions, the detection and exposure of fraudulent practices calculated to injure honorable growers of and dealers in California fruits, and mutual conference in regard to prices."

This report is already too long to permit us to indicate what modifications of detail might be required to adapt the Santa Clara plan to other localities, where the leading products are different from those of the Santa Clara Valley. The plan as worked out is the result of careful study of nine competent men, five of whom are growers and four driers or canners, for the past six months. It seems to us the most promising attempt yet made in this direction, and as such we commend it to the consideration of this convention.

Respectfully submitted.

N. W. MOTHERAL.  
G. M. GRAY.  
ALEX. GORDON.  
EDWARD F. ADAMS.

MR. MASLIN: I will state that I am not prepared wholly to agree with that report, and I hope it will elicit more discussion here, so that we may report back to the State Horticultural Society the result of this consideration. There are some things in the report that I do not think very logical. If we could have gotten together on a certain day, and said we must have a distributing point, why San Francisco would probably have been the distributing point; but as the fruit industry has grown by slow degrees, and very painful ones, too, and a few men in certain localities have been forced to dry fruit because they could not sell it green, it does not follow, therefore, that because San Francisco has not been the distributing point, that it is not necessarily the distributing point for the State of California. The report says that if we made San Francisco a distributing point it will create local antagonism. Who is going to antagonize the right of the dried fruit man to sell his fruit in what place and to whom he pleases? Is it the commission man in those localities? Does he stand as the arbiter of the fortunes of the dried fruit grower? If that is the case the dried fruit grower may just as well go to the commission man and tell him to put his price on the product; it may be so, in fact, but if it is so it is a yoke that every fruit grower in the State ought at once to get rid of, and how can you do it? We all agree that organization is necessary; we all agree that if men sell fruit at their own pleasure, the market is not secure, or safe, or permanent, and the object of such an organization as this, I don't care who denies it, is to fix the price of fruit. Call it a trust or by any other name, that is the object of the organization: that the fruit men may hold their fruit for such a period that they may demand and obtain the price they think is necessary for a living remuneration for their labor. Now, if we wait until each county in the State forms a local organization, we will wait till doomsday. We have been four or five years struggling on this question,

and up to this time one organization in Tulare County, of the raisin producers, and one organization in Santa Clara County, have been the outcome of all the pains, and penalties, and sufferings which the dried fruit men have endured. Now, if it is possible with these local organizations, using Mr. Adams' logic, why has it not been done before? Simply because there are not enough men in a locality to organize. They are afraid of the apparent struggle; they want some leading man to coalesce them, and here is the opportunity. Do not say it cannot be done; let it be tried at least for one or two years, and then we will create out of that central organization other local organizations, that will receive aid and support from the main organization.

COL. MCGLINCY, of Santa Clara: In this county we have at least two very successful coöperative drying establishments in which the growers are interested. Two years or more ago, the West Side Coöperative Fruit Drying Company was organized. It has gone through two business seasons successfully, and the managers have sold the product of that institution for more money than the owners could get themselves. Then there was another organized last spring, and while we have yet no reports from the business, we are satisfied that it will prove a success, and that by reason of this organization the growers will get more for their labor than if they had gone at it as they have been going heretofore—in a haphazard way. The best thing to do is to have the coöperative drier, and then they may send their representatives to a county exchange, and the product can be sold in that way. So far as experience goes in selling fruit by an exchange, I have none, but there are other lines of farm products that have been sold on exchanges with which I am thoroughly familiar. Let us organize at home; let us organize the growers in our midst; let us have the coöperative driers and then the exchange, and the problem will be solved.

COL. PHILO HERSEY: I am connected with one of these coöperative fruit drying associations in this locality, and a word in connection with the result of this year's transactions. We are a community of about seventy-five or eighty fruit growers, and got together and took from one to ten shares apiece at \$25 a share, and bought twenty acres of beautiful ground and the necessary buildings for the purpose of drying and curing fruit. We operated last year, and we think successfully. It is true that out of the seventy-five only about eighteen last year had a sufficient amount of trust in themselves to employ themselves and patronize the institution, but these eighteen (most of them officers, who could not go back on themselves—I, for one—and perhaps that is the reason) did patronize it; and at the time we hauled our fruit to that institution, we could get from \$25 to \$30 for the green prunes. We manipulated the fruit, sold it, paying interest on the investment at the rate of 8 per cent, and all the expenses, and divided on an average \$37 50 a ton—that for last year. There were peculiarities in this valley this year that no one could account for, results that no one could predict. We had a dry season and we had a small crop of fruit; the price of dried fruit was not settled, therefore no buyer knew what he could afford to pay for green fruit. This year, I believe, about thirty out of the seventy-five patronized the institution. We hauled 301 tons of green prunes there and had them dried, and out of that we have sold 153 tons of dried fruit. You will see it didn't take quite two pounds of green fruit to make one of dried; nobody, Mr. Chairman, knew what that result would be. If I

had known it, I would have made \$25,000 or \$30,000 this year instead of making nothing; but I didn't know it. Now, the farmer who joins with others and manipulates his fruit and gets it ready for the market, gets the benefit of such unknown things. You see, our crop was small; there was not sufficient moisture for us; the fruit ripened, but it did not fill up with water, and when thoroughly ripened instead of filling up with juice and water, it began to wither and to fall, therefore the result which I have stated.

MR. AIKEN: A very able divine, when called upon to offer a prayer before an organization that he knew very little of, thought it safe to say, "If there is anything good in this organization, O Lord bless it. If anything evil, curse it." That is about the prayer you should offer in reference to these local and State exchanges. We had some experience a few years ago with a dried fruit exchange, and after paying out the full face value of our stock, we were assessed one half more, and the exchange passed into history. I think our friend Colonel Hersey has delineated the plan of commencing down at bedrock—down where the people live—and working among the producers themselves, who, if they have confidence in themselves, can unite with the local organizations, and from the local organizations form State associations. In a conversation once with Mr. Towne, the manager of the railroad, he very wisely remarked that confidence moved the world; without confidence railroads could not be operated, the business of the United States could not be done. As we all know, there is only a circulating medium in the United States sufficient to do 5 per cent of the business; in other words, 95 per cent of the business of the United States is done on confidence, and not with money. I believe if the fruit growers of California can have confidence in themselves and in their neighbors they can build up the local associations. Confidence will move the fruit crop of the State of California to a lucrative and profitable market, however large the crop may become. There is no such thing as a glut of consumers of fruit living all over the United States and in European countries.

MR. MASLIN: When I was a boy in a debating society, I had a friend who always made one answer to any argument. He was a theological student, and said, "What does Paul say?" and that seemed to be an absolute answer to any proposition. Now, the question before this convention is the proposition to establish a fruit exchange, and I believe with the speaker who has expressed himself, that the question is in the same category with my college friend who says, "What does Paul say?" They have drawn three or four beautiful pictures of coöperative associations in local communities. Now I ask you, Do the people propose to erect a fruit-drying establishment in San Francisco? Did they ask you to bring the fruit to San Francisco and let us warehouse it? Not at all; the drying and preparing and processing of the fruit can be better accomplished by local organization; but when you come to sell the fruit, that is the point. Take an organization of say twenty counties; they stand as a unit of one man, and you will see that the fruit buyer will accede to the price fixed by that organization. Will you tell me that the fruit growers of Santa Clara County can fix the price for all the fruit of California, when down in Ventura the apricots are sold for \$15 a ton? You must have a coöperation of all the fruit growers in a common center, or you are left at the mercy of the broker and the fruit buyer, and your object is to overcome that very thing. Do Santa Clara fruit men



mean to say that when it is known that the fruit buyer can buy cheap apricots in Ventura, they can demand their price in Santa Clara? Fortunately, for one year they did it. A concatenation of circumstances enabled them to do it, but will they do it in the future? I believe that every State and every distributing point has succeeded best where they have controlled the markets of their provinces. It is so in Europe. You go to certain cities and you find a place there where all the producers and consumers meet. It is the world's fair, as Mr. Berwick has said in reference to counties. The producer and consumer, the middle man and the merchant, use a common center to adjust the business, and how can the fruit grower, separated and apart as he is, adjust the prices for his fruit when he does not know but that some other section is cutting his feet from under him? You need the practical experience in this thing. But why couldn't this fruit be sold by sample? Suppose you were in Ventura or San Joaquin, or any other county, and sent a sample of your fruit to a common center, where the manager is receiving his advices from everywhere and fixes the prices at which the sample can be sold. You have got the fruit product of California in your hands, and a lot of brokers running all over the State taking your feet from under you. It is so with the wine business. Is there a wine man in the audience who does not know that the weakness of the wine industry is because they are not organized? When a man goes to San Francisco to sell his wine, he goes to a wine merchant and is offered 10 cents. He goes to another merchant. But the telephone runs between the offices, and he completes the circle and is only offered 8 cents. So it will be in a larger degree with the fruit produced in this State.

MR. ADAMS: Upon the proposition of a State exchange based upon the theory of local exchanges, we are unanimously with you, but upon the proposition to establish a State exchange—not a representative body, but an original body composed of individual bodies all over the State—we do not agree with you; and the proposition that ought to be discussed as between our report and the paper of Mr. Bancroft, is whether a State exchange based upon local exchanges is the way to operate.

An adjournment was taken till Thursday morning.

## XIV.

## TRANSACTIONS OF THE THIRD DAY.

THURSDAY, November 17, 1892.

The convention was called to order at 9 o'clock A. M.  
President COOPER in the chair.

## FUNGOID DISEASES OF THE GRAPE.

## COULURE,

OR THE DISEASE RECOGNIZED BY THE DROPPING OF THE YOUNG AND UNDEVELOPED  
GRAPES IN THE EARLY SPRING.

Essay by N. W. MOTHERAL, of Hanford.

Mr. Eisen, in his work "The Raisin Industry," in an article styled "Powdery Mildew, or Uncinula," uses the following language:

"The mildew appears at two different stages: one in the spring, when the vines are in blossom; the other again later in the summer, when the fruit is more advanced. The first stage of the mildew resembles a fine cobweb spun between the flowers of the bunch. If allowed unrestricted sway, the flowers will drop off, the fruit will never set, or set only imperfectly, and the crop will be a great loss or even a total failure. Generally the inexperienced vineyardist does not perceive the mildew until too late. A slight touch to the vine will then bring down all the young fruit or blossoms like a shower, and the stem of the bunch will be seen to be entirely bare, or with only a few scattered berries. This form of the *Uncinula* mildew has not been as scientifically investigated as would be desirable, and nothing is known as regards its development. It is possibly a primary generation and early stage of the later *Uncinula*. I believe this form of the mildew is identical with the disease which is called coulure by the French, and which is characterized by the dropping of the young, undeveloped grapes. The first appearance of this mildew is always accompanied by white, salty excrescences on the edges of the grape leaves. Whether they are directly or indirectly connected with the fungus is not known."

This unsatisfactory description of coulure is perhaps as good and clear as any we have in the literature on the subject. Three years ago, while acting as Special Agent for the State Board of Horticulture, I was lead to doubt the correctness of Mr. Eisen's statement, that coulure is an early stage of powdery mildew, and commenced experimenting with a microscope, and soon discovered that coulure is not a fungus, but a salt. I also discovered that it originated from the sap and is held in solution, and when the water was evaporated upon the surface of the leaf the salt was left behind. I also discovered that the delicate stems, flowers, and young berries were covered with the same salt, and that the dews at night would dissolve this thin stratum of salt, which covers every part of the growing plant (where evaporation has been going on),

and that gravity would take the fluid to the lowest point of the leaf or stem, and that the sun the next day would evaporate the water and leave a white ring around the margin of the leaf, thus accounting for the statement made by Mr. Eisen, that the first appearance of this mildew "is accompanied by white salty excrescences on the edges of the grape leaves." I also discovered that this salt was corrosive, and burned the surface of the leaf and destroyed the flowers and young berries. Thus the theory was exploded in my mind that coulure was the first form of powdery mildew.

The spider-web appearance alluded to by Mr. Eisen is indeed the web of a gossamer spider. There is also connected with every growing grapevine a substance resembling somewhat a spider web, but more accurately resembling spun glass, which deceived Mr. Eisen, and perhaps others who have attempted to investigate this subject with a microscope. This substance is seen upon all healthy vines as well as diseased ones.

*Remedy.*—The foundation of the difficulty is in the soil or climate. If the salts were not in the soil they would not be in the sap; if the nights were not so much colder than the days there would be no suspension of circulation, and there would be no chemical change in salts contained in the sap.

I learn from parties from the vine district in France that this disease, years ago, when the vines were first planted, was very destructive, but now it has almost disappeared, because the salt producing the trouble has been exhausted from the soil. The remedies we have been using, to wit: sulphur in any of its compounds, is utterly useless, and is an expenditure of money without any profit. Many farmers in Fresno and Tulare Counties have discovered this by experiment. The Tulare County grape growers, under the advice of its County Board of Horticultural Commission, have decided not to use sulphur in the early spring. Mildew is a disease almost unknown in the open fields in the county, and is only observed upon vines that are trained upon trellis-work about the houses.

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#### MISCELLANEOUS ENTOMOLOGICAL NOTES.

By PROF. C. W. WOODWORTH, of Berkeley.

Many questions that are of considerable general interest are continually arising in the correspondence of the Department of Entomology at the University, and I take advantage of this occasion to present a few of those most commonly recurring, believing that by so doing I will not be repeating facts known to all.

First, in regard to the arsenites there have been many questions. There are three substances of this class sometimes used: Paris green, which is an arsenite of copper, and is insoluble or nearly so; London purple, which is an impure arsenite of lime, containing much aniline and sometimes some white arsenic, and is sometimes for this reason slightly soluble; and finally, white arsenic, also called arsenious acid—a combination of arsenic and oxygen. White arsenic is quite soluble, especially in hot water. All the arsenites are more or less injurious to the growing parts of plants, and it seems that the more soluble it is the more injurious it becomes. For this reason Paris green is generally the safest. It is also the most expensive, and it appears to me that a home-made



arsenite of lime would be the cheapest and most satisfactory insecticide. In mixing arsenites with other washes we should remember that both acids and alkalies make the arsenites more soluble. The same is true in regard to soapy washes, which act in this respect like simple alkalies. Lime acts in the other way, making them less soluble. White arsenic makes a very valuable addition to an alkaline wash, but must be used in very small quantities.

The method of spraying with arsenites should be very different from that employed for washes against the scale insects. The stream must not be forced against the leaves, but be applied like a gentle mist. This can generally be best accomplished by standing as far from the plant as the stream will carry. The application should be made very evenly all over the plant, and no more used than barely enough to make the leaves begin to drip. The same is true in regard to spraying for almost all insects besides the scale insects, and also for fungi. The pressure used for spraying for scale insects in this State is much greater than is usually employed, and the nozzles are often coarser; but whether this is a loss or an advantage is a matter not well established. I expect to be able to speak more definitely on this point after the apparatus for testing pumps and nozzles, which is being constructed for the University, is completed. At any rate, it may be said that low-pressure pumps and fine nozzles are very satisfactory. The proper relation in size between the pump and nozzle is another matter we will be able to discover by the use of the new apparatus.

Another subject which was the burden of a great number of letters was what was to be done in the case of unknown or doubtful plant diseases. These were sometimes fungoidal and often complications of a number of troubles, but a large number were those whose causes were entirely unknown to science or of a highly problematical nature. Indeed, of these unknown diseases this State is peculiarly well supplied. Generally it is best to treat a doubtful disease as a fungoidal disease; that is, spray it with fungicides. Of these, the best to try, perhaps, is the Bordeaux mixture or the ammoniacal copper carbonate. Another good thing to do is to destroy by burning, if possible, the diseased parts or plants. Do not replant on the same ground.

Finally, I wish to speak of a little insect known as the thrip. There are two classes of insects which commonly receive this name. The false thrip of the grape and other plants is a leaf hopper of the family *Jassidæ*. We have tried a good many remedies for this insect, with no success; that is, remedies that are practical in the field. Among others we tried the lantern traps, which have been recommended, and they were the most dismal failure of all the remedies tried, as I could not find that I had killed any of the insects in question, even surrounded by vines swarming with them. The true thrip is a smaller insect and belongs to the *Thripidæ*. I learn that they have long been observed in the State, doing a good deal of injury, but their nature does not seem to have been recognized, for I have been so far unable to find any published account of their work. Their work has probably been confounded with that of the red spider, which they very much resemble. There is no web made by these insects, which will enable one to readily distinguish them from the red spider. The past season they were very bad on pear, prune, and almond in some parts of the State. I was unable to try any remedies. They should be looked for next season.

## FOREIGN PESTS AND DISEASES.

By ALEXANDER CRAW, Quarantine Officer and Entomologist of the State Board of Horticulture.

Threats have been made by the Association of Eastern Nurserymen, that unless the quarantine laws of California were repealed, or the regulations thereunder were relaxed, they will institute a boycott against California fruit and inaugurate other measures to injure the fruit industry of this State. These threats are made because, in self protection, and for the protection of the greatest industry of the State, the State Board of Horticulture has refused to admit trees infested with contagious diseases or pests, and more especially trees grown in districts known to be infected with peach yellows and peach rosette.

There is nothing in our laws or quarantine regulations prohibiting the introduction of healthy stock from any State in the Union or any part of the world. The Eastern nurserymen—or the portion of them represented by the association—seem to labor under the mistaken idea that our laws are in some way aimed at them; that they have been passed and enforced for the purpose of injuring them in their business. It is not necessary to state here how unfounded this impression is. We are not devoting our time and labor to their injury, but to our own protection. It matters not to us where trees are grown. If they are healthy they will find a welcome, but if they are infested with pests or diseases which threaten our very life, they will be destroyed, even though it were possible for the Eastern Nurserymen's Association to carry their threats into extreme execution. We had better have clean fruit for local consumption, and no markets whatever, than the whole world for a market with no fruit to supply it. We have no fight with Eastern nurserymen, and want none; whatever they may threaten or do we have no desire to retaliate, for such action is childish; but whatever comes we will obey the first great law of nature—self-preservation.

During the past season thousands of trees have been quarantined and destroyed, because they were discovered to be seriously infected with dangerous insect pests. These were imported not from the Eastern States alone, but from many parts of the world. There were other thousands of trees and plants from the East and elsewhere, which examination showed to be clean, and these were passed without trouble. I allude to this to show that our laws and regulations are neither prohibitory nor vindictive, and are not passed with a view to injuring any one.

The fruit growers of California have had some very expensive experience with imported pests and diseases. I might instance the cottony cushion scale, which so nearly destroyed one of the most important branches of horticulture in our State, and lost the State and people millions of dollars, in loss of crops, loss of orchards, and expense of fighting. This is but one instance out of many, and so far from relaxing our protective measures, I should rather advocate the tightening of them. We know that numerous destructive pests exist in other parts of the world, and we know too well, from sad experience, what their introduction here means. We have no desire to experiment with them, and are in nowise anxious to discover the amount of poison they can consume, the quantity of "bug juice" they can imbibe and live, or the volume of gas they can inhale and still retain their destructive and reproductive powers.

In my early experience in horticulture in California, I remember the fruit trees were comparatively clean; no damage had then been done by insect pests, at least to any appreciable extent, and "our glorious climate," in which everything else under the sun would thrive, was credited with being an unhealthy thing for bugs. We had then so much faith in our climate that we really believed it to be a sort of patent reversible arrangement, that was good for what we wanted it good for, and bad where we wanted it bad. But, alas! it did not prove so. At that period no one had suffered financial loss from this source, and firmly believing that in our great State there was room enough for all, we let these little insignificant bugs go on reproducing themselves as rapidly as they saw fit, and had no thought of molesting the little fellows. But it soon dawned upon our understanding that they were bigger than we, and worked while we slept, or at least they outnumbered us so vastly that bulk could not hold against numbers, and we became convinced that either the orchard or the bug had to go. It was painful and costly experience that impressed this knowledge upon us, and we were forced into the fight. At a vast expenditure of money and labor, to say nothing of patience and temper, we are in a fair way to become masters of the situation, and we cannot afford, out of esteem for our brother nurserymen in the East, to abandon the fight on the verge of victory, and allow them to undo all that we have struggled so hard to accomplish.

The charge made by our Eastern friends that we have been influenced in our action by mercenary motives, and that the sole object of our quarantine laws has been to promote the business of our local tree dealers at the expense of the Eastern nurserymen, is too puerile for notice here. The California nurserymen themselves objected to the quarantine law as interfering with their business, and as most of our nurserymen are to some extent importers, if any hardship was worked by it they, more than the Eastern people, suffered. But the passage of protective measures was demanded by the fruit growers of the State as the only salvation of their business, and the tree growers soon saw the justice of the measure and conformed to its requirements.

There was a class, however, to whom it worked a hardship. This was composed of unscrupulous real estate dealers, who would purchase cheap land, get the cheapest stock they could find in the country, without regard to its condition or the safety of adjoining orchards, set this out upon their land, get it started, and then sell the "orchard" at a low price, but with a big profit to themselves.

As showing that there is still occasion for us to be on the alert, and take every precaution to prevent the introduction of new pests and diseases, I will mention a few that are very serious, that do not now exist in California, but which are liable to be introduced upon trees or plants.

The first of these, as the most threatening danger, are the peach yellows and the peach rosette. Wherever these diseases have been introduced they have spread with rapidity and fatal effect. When a peach tree is once affected death is as sure as it is in the case of a man attacked by leprosy. The only remedy is to uproot the affected tree and destroy it; no other known treatment is successful. Interested parties have asserted that because the disease has not yet obtained a foothold here it cannot exist here; that there is some mysterious quality in our climate that is detrimental to these destructive peach diseases. We used to think so about bugs, but when the bugs came all that the glori-



ous climate of California did for them was to furnish superior opportunities for their increase. We cannot afford to make the experiment with the yellows or rosette. I have been informed by Mr. Stratton, of Petaluma, that in 1855 there was a well-developed case of "peach yellows" in Father Taylor's orchard, in the town of Alameda. It was introduced from the East upon two "Morris White" peach trees and spread to the adjoining trees. It was recognized and pronounced a genuine case by the foreman of Frost's Nursery, of Rochester, N. Y., and he advised the destruction of the trees in that neighborhood. This was done, so the vigorous measures saved the peach orchards of the State.

The peach rosette is of more recent origin than the yellows, but not less fatal. It resembles the yellows in that it can be transmitted to healthy trees by budding, and a single bud from a tree affected with either disease put into a healthy tree will cause its inevitable death in about two years. It is an absolute impossibility to detect the germs of either disease, and not until its deadly work has made itself manifest can it be known that the disease is present. The germs of either or both of these fatal diseases may be present in imported stock, and no knowledge could be had of it in the young stock. The only safeguard against its introduction into our healthy orchards, therefore, lies in the absolute prohibition of the importation of trees from the infected sections.

Another pest which we do not have and do not want is the plum curculio. Let it once gain a foothold in our State and the profits of the growers of prunes, apricots, and cherries would be materially reduced, if indeed they might not be reckoned in ciphers. The newspapers would not then be filled with glowing accounts of the enormous profits which Mr. Brown made from prunes, Mr. Jones from apricots, or Mr. Robinson from cherries, for the little bug once at work would toil with tireless industry to place the figures on the loss side of the ledger. And he would come very near accomplishing it, too. We have no use for this industrious little individual in our State, and no curiosity to find out even whether our climate will agree with him. And to keep him out of employment here all trees arriving from the East must be carefully examined and all soil attached to the roots, together with the packing in which the trees arrive, be removed and burned. This process will effectually destroy any of the beetles that may possibly be concealed.

The black aphid is a new peach pest that has made its appearance in several of the Eastern States, and has proven as destructive as the yellows. It attacks the roots of peach trees very much as the woolly aphid does those of the apple tree, but is infinitely more destructive. Records are made of nurseries of 100,000 trees, in the Eastern States, being killed outright within three weeks after they were attacked. California had a very narrow escape from this pest last winter. A large shipment of peach trees was imported into Santa Clara Valley from the Eastern States, which was found to be infested with this pest. The entire shipment was destroyed and the danger averted. The black aphid differs from the common peach aphid (*Myzus persicæ*) in being jet black in color, with a shiny body, of vastly greater fertility, and the fact that it breeds upon the roots as well as upon the leaves and branches. Prunes budded on peach stock would be liable to attack equally with peach.

Another pest infesting Eastern peach stock are root-borers, but of this family we have a native species, which in some parts of the State is very troublesome.

Trees imported from Florida have generally been found to be infested with purple, long, Florida red, chaff, and wax scales, and have to be subjected to fumigation before they can be passed. During the past season inspectors have found small colonies of these scales upon trees which arrived three years ago, and were planted without being disinfected. These trees were subsequently treated and the insects destroyed.

To be forewarned is to be forearmed, and for the benefit of the members of this convention and the fruit growers of the State, I present here a list of some of the more destructive pests which we have not yet got in California, and against the importation of which we must be upon our guard:

The curved-wing apple moth (*Erechthias mystacinella*) is an Australian insect, which in its young or larval state burrows into apple trees, generally around the warty excrescences caused by the woolly aphids. They gnaw into and tunnel the wood of the tree in such a manner that air and moisture are admitted, and the tree becomes weakened, and breaks down. There are three or four broods in Australia each year. The larvæ or borers are about half an inch in length, and of a pale greenish color. The moth has a spread of half an inch. But it is the borer that we have to look for in imported trees. This pest is known to attack other trees, especially the acacia family, so it is well to keep a close watch for it.

In Australia and Tasmania is found another apple-boring pest. It is a small beetle that burrows into the trunk and large limbs of apple trees. The full-grown beetle is about one quarter of an inch in length; it has a curious curved thorax, with the head turned under. When numerous, they cause the tree to wither and die. They can be detected by the openings of their burrows. Trees infested with either of these borers should be destroyed immediately upon their arrival.

The roots of trees, especially apple and other fruit trees, have to be carefully examined, as in Australia they have two species of curculio, the young of which cut long furrows in the roots. Unlike other borers, this species is exposed and works in the bark and sapwood, and as that is really the vital part of the plant, the tree soon withers and dies. The grub of this beetle, when full grown is nearly one inch in length, and three sixteenths of an inch in diameter. It will thus be seen that it is capable of doing considerable mischief. The borer is yellowish-white and the perfect beetle is grayish-brown.

Another serious pest, and a more general feeder, that has to be guarded against, is the *Marogo gigantella*. The larvæ of this moth burrow into cherry, peach, apricot, and plum trees. When full grown they measure nearly two inches in length and are pinkish-white with a dark head. Of course, in their primary stages these borers are very difficult to detect, and the inspection of all imported stock should be very thorough.

A fig leaf beetle (*Galerucella semipullata*) occurs in great numbers upon the wild and cultivated figs of Australia. The perfect insect feeds upon the bark and the larvæ upon the leaves and buds. The beetle measures a little over a quarter of an inch in length and is dull reddish-brown and covered with fine silky gray down; the head and thorax have each a large brown spot. The eggs are laid in patches of from fifty to one hundred and twenty; they are pale yellow and attached to the leaf or stem, and as the female prefers to deposit them upon the young fig trees it will be seen that we run great risk in introducing fig trees from

the antipodes. Any soil adhering to the roots should be removed and thrown into a fire, to destroy any pupæ or beetles that may be hibernating therein. As fig trees in California are exempt from the attacks of insects, great care must be taken to see that this pest is not introduced.

Trees of the pine family should be carefully examined, for in Australia there is a serious pest in the form of a moth upon *Pinus insignis*. The larva is brownish-black, with the head and thoracic segments dusky white and irregularly mottled with small brownish spots. When the larvæ are full grown they measure about one inch and a half in length, and are protected by pieces of pine leaves held together by silken webs spun by the larvæ. In the pupa stage they suspend the mass of web and leaves by silken threads to a branch, and after a time change to the adult stage. The male of this moth is winged, but the female is wingless and legless, so remains within the pupa case and deposits her eggs at the opening thereof, where the young hatch and spread to the other leaves.

Australia and New Zealand have probably a greater number of species of scale insects than any other portion of the world. An examination of the contents of the cases upon exhibition will show a number that have been found upon imported trees and plants. The cottony cushion scale and the destructive red scale of the orange were introduced upon trees from Australia. When established in California, where we had no natural enemies to keep them in check, they increased to such an extent that hundreds of thousands of dollars were spent in the warfare against them. This expenditure of money was a positive necessity, in order to keep the trees alive, for in one to two years the orchards were in such a condition that they were practically worthless. Finally, the natural enemy of the cottony cushion scale was introduced and the devastator was laid low. Other ladybirds and predaceous insects have been collected by Mr. Koebele in Australia, and have been colonized in different portions of the State, and we look for good results from them upon the red and black scales. This system of fighting injurious pests with other insects is the proper course to pursue, and every assistance and encouragement should be given it.

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#### BENEFICIAL INSECTS.

The President announced that the report of Albert Koebele, who was detailed (by the Department of Agriculture, through an arrangement with the State Board of Horticulture) to go to Australia and adjacent countries for the purpose of importing parasites and predaceous insects, would be read, for the information of the convention. As said report was a report to the State Board of Horticulture, it would appear soon in a special bulletin, and afterwards inserted in the proceedings.

#### NEW SPECIES INTRODUCED.

To Hon. ELLWOOD COOPER, President, and to the honorable State Board of Horticulture:

SIR: At your request I give herewith some notes of the condition of fruit trees and the coccids injurious thereto in Australia, also the work of natural parasites upon the same in that country, as found during my recent mission; at the same time giving you a statement as to how I



found the recently introduced species on my trip to Los Angeles and Santa Barbara at the beginning of September, 1892, and my opinion of their future work in this country.

My report upon this last trip has been forwarded to the Secretary of Agriculture, to whom I had to report as directed in letter of authorization, dated May 29, 1891. In it I give a full account of all the beneficial insects found and forwarded to this country, as also of such as were studied in the field, and which may be introduced at some future time. As this report will not appear in print until some time during 1893, I will briefly acquaint you with what was accomplished.

As you are aware, my chief work was to search for such parasitic and predaceous insects as prey upon the coccids injurious to our fruit trees. These are the so-called red scale (*Aspidiotus aurantii*, Mask.), detrimental to our orange trees; the pernicious scale (*Aspidiotus perniciosus*, Comst.), upon and destructive to various deciduous trees; and the various black scales (*Lecaniums*), as the principal species.

The red scale is present all over Australia upon citrus and various other trees and shrubs, and has been known upon orange trees for the last fifty years. Whether the insect is a native or introduced cannot be said with any certainty, but as the conditions indicate, I think it is an introduced species. Internal parasites could rarely be found upon the same; chiefly upon the male scales, small holes were occasionally found, from whence minute chalcid flies had issued. None of these were bred.

The black scales are represented by various species, and our most common forms, *Lecanium oleæ*, Bernard, and *L. hesperidum*, Linn., are found everywhere in New Zealand and Australia, and in my opinion are indigenous to the latter country. Numerous internal parasites were found preying upon these two coccids, and were repeatedly sent here. It is in predaceous insects feeding upon the various coccids that Australia is immensely rich, and these are chiefly ladybirds (*Coccinellidæ*).

The group *Orcus* resembles our own form *Chilocorus*, of which *C. bivulnerus* is well known in California. The habits are the same; they will breed upon a variety of scales from early spring until winter, when the mature insects will hibernate for a time. Four species of these were sent here, and two of them, *O. chalybeus* and *O. australasia*, in very large numbers. *Cryptolæmus* was found in two forms, *C. Montrouzieri* and *C. australis*. The larvæ of these are peculiar, as they are covered above with contiguous, white, mealy, secreted appendages; they feed chiefly upon mealy bugs (*Dactylopius*). The first named species, which was sent here in large numbers, is also doing good work in feeding upon the various black scales.

*Bucolus* is closely related to *Cryptolæmus*, and two forms were sent here. Probably the most valuable of all the scale-feeding *Coccinellidæ* are the *Rhizobiids*. This group is very largely represented in Australia, and only a few forms are reported from other parts of the world. America had none previous to this importation. The insects are closely related to our *Scymnids*, but some of the species are much larger. They feed upon all sorts of scales, and their larvæ were found at all times during the year in Australia. Some fifteen species, nearly all unknown to science, were sent here.

*Scymnodes* also resembles *Rhizobius*; but one species, *S. Koebelei*, Blackburn, and a variety of the same, named *varipes*, were sent here. These are expected to feed upon black scales and *Chionaspids*. *Erithionyx* is

quite a large black beetle, covered with short, yellowish-brown hairs; the one species, *E. lanosus*, was found feeding on *Chionaspis*, upon orange trees infested with black scale, and was repeatedly sent here. These species were liberated by you upon *Lecanium*.

*Scymnus* is known to almost every one; we know the value of our *S. marginicollis* in California, and the good work it is able to do upon a variety of scales. I have so far eight species named from Australia and a number from New Zealand, which were sent here. These can be expected to feed upon most of our coccids.

*Mydus* resembles a *Scymnid*, and *M. pygmaeus*, feeding upon mealy bugs, was sent here; and there are a number of groups of small, roundish *Coccinellidæ*, of which *Gynoscymnus*, *Cycloscymnus*, *Libernes*, *Cyreme*, and *Serangium*, found upon a variety of coccids, were sent here.

As to the aphid-feeding *Coccinellidæ*, all the species that could be obtained were collected and forwarded. Some of these will not only feed upon plant-lice, but will also live upon scale insects. *Coccinella antipodum* has only been found by me to prey upon scales in New Zealand. *Coccinella arcuata* was found in southern Queensland feeding upon the orange aphid, but on the Richmond River, New South Wales, the same insect was feeding upon *Lecanium filicum* on a fern, and again at Levuca, Fiji, it was feeding upon an *Aleurodes* on taro leaves. *Leis conformis*, which feeds on plant-lice, will, after these have all disappeared, begin its destructive work upon the woolly aphid, of which it cleans whole orchards, as observed in South Australia and Victoria.

In all, some forty thousand specimens of ladybirds were collected by me during this last trip, and forwarded to California, and I can say positively that no mistake was made in sending anything but beneficial insects.

It was timely discovered that nearly all the larvæ of the ladybirds in Australia are preyed upon by parasites, in certain instances almost destroying all of these. The pupæ are also preyed upon by chalcid parasites, and in consequence only the mature insects were sent, thus leaving all their enemies behind, and we shall thereby have the benefit of the work of these insects without the detriment of the parasites preying upon them.

One of the best enemies to the black scale in Australia is the larva of a small moth (*Thalpochares*), which builds itself a house, so to speak, by spinning together the remains of the eaten-out scales, etc. With this protection against its enemies, it is able to walk over the tree, and thus devours large numbers of the scales daily. The transformations of this insect have not been closely studied in the field, but from what I have seen must be very rapid, especially in warm weather; and as full-grown larvæ were found upon the same tree about every two weeks, it will take at the most four weeks from egg to mature insect during summer. When full grown the larva spins most anywhere on the tree, but prefers any crevice on branches or trunk of tree, between the forks, and also on the ground at the base of stem. According to the season or circumstances, they may pupate at once or remain for several months, and in no case should they be disturbed in any way, for if taken out of their cocoon they will rarely be able to spin another and will invariably perish. Two species were found in Australia, and one at least is introduced and established.

The trunks and branches of citrus trees in Australia are often covered

with fine, silky webs interwoven with remains of scales, and under this are found numerous larvæ of a small *Tineid* moth that devour the coccids thereon. These latter are chiefly *Chionaspis citri* and *Mytilaspis Gloverii*. Efforts are now being made to introduce this valuable little moth here, and a number were liberated upon trees infested with the pernicious scale.

Aside from the numerous parasites and predaceous insects destructive to scale insects in Australia, there exist several species of fungoids detrimental to various coccids. *Microcera coccophilla*, if once started upon a tree infested with the red scale, will keep on spreading until all the scales are destroyed. The same may be said of the fungi living at the expense of the black scales. I have had a number of small orange trees infested with *Lecanium*, on which also were ants that kept away the natural enemies—upon which the *Thalpochares* larvæ were collected regularly, as these, with their protecting armor, are quite safe here—on some of which the fungus began to spread until every black scale upon the trees was destroyed. The fungus will apparently only grow during damp weather, and I shall try it in the early spring. If once started this could easily be disseminated.

The condition of the olive tree, as observed in South Australia, is fairly good. Some of these are more or less infested with black scale (*Lecanium cassiniæ*, Mask.), but notwithstanding this, trees seen on a hillside, growing wild, so to speak, were loaded with fruit, and but few of the trees had scales in quantity. It was a time when everything was completely dry that I visited South Australia, and the predaceous insects found feeding upon these scales may not be all that prey upon them at other times of the year. The species found in larva, pupa, and imago state upon olive were *Rhizobius hirtellus*, *R. cæcus*, and *Cyreme nigellum*. The first-named species was present in very large numbers, and was found upon various scales in New South Wales, as also other coccids. Both the larvæ and pupæ of the *Rhizobiids* were found destroyed in large numbers by parasites.

In New South Wales, where my work kept me during the time among the orange trees chiefly, the species of *Coccinellids* found preying upon *Lecanium* were far more numerous. I will mention but a few, which are always present in large numbers with the black scales. These are: *Orcus australasia*, *Rhizobius ventralis*, *R. hirtellus*, *Cryptolæmus Montrouzieri*, and the larva of the *Thalpochares* moth, which alone is able to free whole trees in a very short time. It is only upon bushes or young trees generally covered with large numbers of ants, which prevent the predaceous insects from coming near, that the black scales become numerous. Upon old trees these coccids are but rarely found in numbers, and if so, only upon an occasional branch, which is speedily cleaned again by the numerous predaceous insects preying upon them.

The red scale (*Aspidiotus aurantii*) is, perhaps, aside from *Mytilaspis Gloverii* and *Chionaspis citri*, the most numerous coccid upon citrus trees in Australia, and in fact is at present the most injurious to citrus trees in that country; but its progress is checked by its natural enemies. Australia is in possession of more than enough natural enemies to keep this coccid in check with ease, although nearly all these are preyed upon by parasites. To spray or fumigate to kill the red scale would also mean the destruction of the numerous beneficial insects, and those that were not killed outright would mostly leave the orchard in search of other



food, and the consequence would be that in a few months the trees would again become infested, with but few enemies present, and the scales would do great damage unless "the spray is again applied."

As it is, at the present time in Australia, orange and lemon trees are often planted in almost any locality, without regard to the situation, condition of soil, drainage, climate, and other conditions. The consequence is that some of these orchards become diseased, presumably from the effects of the red scale, and, as is the case in the Gorden district, near Sydney, one tree after another will succumb. An examination showed that these trees had been planted in heavy, clayey soil, without any drainage, and were invariably destroyed by the so-called "foot-rot." The fact is, that if an orange or lemon orchard, as the case may be, is left for years without any attention whatever, the weeds allowed to grow, and planted in an unsuitable location or soil, before very long the leaves become yellow and drop off slowly, and in time the remaining green leaves become covered with red scales, since, as is always the case, the predaceous insects preying upon this scale will not be found on such trees, as they prefer those with dense foliage and shade. Such trees may thus linger for months, or even years, before dying, and may even again recover if proper attention is given them. In one of such orchards, of several acres in extent, but a few living twigs covered with red scale were found, yet not a single one of the many predaceous insects preying upon them could be noticed. In another instance, an orchard of some eight or ten acres and about thirty-five years old, the proprietor of which always supplied sufficient manure and kept the ground cultivated, during the whole time of its existence had been infested with red as well as other scales, and yet but a very few trees along the border of one side could be found that showed any traces of such. The whole orchard during the thirty-five years had never been pruned or sprayed, nor even had the trunks ever been washed. Numerous dead limbs were present, the stems and limbs partly covered with lichens, and yet I did not meet with a finer lot of trees in Australia—such glossy, deep-green foliage, abundance of fruit, and so free from scale.

A large number of predaceous insects were found preying upon the red scale in Australia. Of the most numerous were *Orcus chalybeus*, *Orcus australasia*, and *Rhizobius satellus*. Aside from these, numerous other species of *Rhizobiids* were found preying upon this scale, and many species of *Scymnids*, all of which were sent here. In my report all of these are treated separately.

On my visit to Los Angeles and Santa Barbara in the beginning of September, *Orcus chalybeus* were found at Los Angeles, where this species was liberated upon the red scale, in such numbers that we can reasonably hope they will have increased by next April, so that we may distribute them throughout many orchards.

The condition in which the insects liberated by you upon the olive scale were found was even better than I had expected. The species present were *Orcus chalybeus*, *O. australasia*, *Rhizobius ventralis*, and *R. debilis*. Without doubt other species sent to and liberated by you will appear in large numbers next spring. It is impossible to find, within a couple of hours' search, all the species present in a large orchard. *Orcus australasia* and *Rhizobius debilis* are feeding upon the pernicious scale (*Aspidiotus perniciosus*) at Alameda, where they were liberated by Mr. Craw, who at the same time left a number of *O. chalybeus* upon these

coccids; but these have all disappeared, though, positively, not to die. They will be found upon *Lecanium* or *Chionaspis* in time. I have never found this insect feeding upon *Lecanium* in Australia, and did not expect it would feed upon *L. oleæ* with you; but this will only show that a coccid-feeding ladybird, if at liberty, will most always find its food for future generations, and no doubt most of the species liberated here will be found again in numbers upon some scale.

In regard to the two species of *Orcus* we now possess, they were found, if my observations in the field are correct, to be two-brooded in Australia, the mature insects hibernating during winter. The *Rhizobius* are much faster in breeding, and I estimate about six broods per year. The larvæ of these, although not numerous at the time, were found in midwinter.

These insects here, with but few enemies, should increase about fifty-fold with each brood, and from one female of *Orcus* we should expect about 2,500 beetles at the end of the season, under favorable circumstances; while of *Rhizobius*, with six broods, upwards of 15,000,000,000 beetles could be expected, and these figures will not be much out of the way in your orchard, where there is an unlimited supply of food.

On a day when the temperature reached above 100° F. in the shade in Australia, the number of *Orcus chalybeus* upon each orange tree could be estimated, as all the beetles came down on the stems near the ground, which was a beautiful sight for an enthusiastic bug-hunter, and from 175 to 300 beetles were collected on each stem; but the larvæ of the same upon the trees were probably ten times as many. It should be understood that these trees are never sprayed.

Some 1,500 different beneficial ladybirds are known at present in the world, and more than half of these will feed upon scale insects. We should do our best to import as many of these as possible, and at the same time guard against any new importations of coccids.

It is not that we should exterminate our scale insects—this is a matter of impossibility even with the best of natural enemies or parasites, and would be contrary to nature; but we can, with the proper natural enemies, keep these insects in check to such an extent that they will not injure our trees, and fruit growing will be possible for all time to come.

Respectfully yours,

ALBERT KOEBELE.

ALAMEDA, CAL., November 14, 1892.

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#### DISCUSSION ON MR. MOTHERAL'S PAPER.

MR. BLOWERS: I suppose I have had as much experience with the Muscat, the raisin grape of California, as any other man in the hall, consequently I am interested in regard to this coulure spoken of in Mr. Motheral's essay. I find in my experience that there is not one cause alone, but several causes that will produce it. In the first place, if you irrigate, just previous to the blooming of the Muscat, with cold water on a cold day, it will produce a decided loss of your crop; you can irrigate with more water three weeks later, when a second crop is blooming, and it will produce no such result, from the fact that it has not checked the circulation of the sap, which is followed by an increased circulation that destroys the bloom; consequently, it is injurious to irrigate, preceding

the blooming, with cold water. Second, as to the thrips spoken of by Professor Woodworth. I have spoken with more than fifty persons who have suffered from the effects of the thrips, and I have not been able to find any way of getting rid of them; probably that will come some other time, but the thrips propagate in the terminal bud of most all of the trees we grow, especially the apricot and the prune, and as quick as the grape begins to come into bloom, it lives on the honey and prevents the fertilization of the flower. I have no objection to the proposition made by Mr. Motheral in reference to the exudation of salts; it is probably in some places correct, but there are probably not less than four antagonistic causes that produce the dropping of the Muscat. Do you find this coulure confined to certain varieties of fruit?

MR. MOTHERAL: It affects the white grape most. You find it a little upon Thompson's Seedless and Seedless Sultan, but with the black grape I have never discovered it.

MR. BLOWERS: It is always with those that bloom after the cap has been removed from the flower. The fertilization of the Tokay takes place under the cap, before it becomes disassociated with the stem; the fertilization of the Muscat takes place after the cap has been partially removed. I find in my experience of thirty years that the coulure affects no grape that fertilizes underneath the cap.

MR. MOTHERAL: Will Mr. Blowers tell us if it is a fact that all the black grapes fertilize just as the Flaming Tokay?

MR. BLOWERS: Not all of them.

MR. MOTHERAL: What varieties do not that you know?

MR. BLOWERS: I think the Portuguese grape, called the Black Ferrara, fertilizes like the Muscat and is subject to the coulure in the same way.

MR. MOTHERAL: I have not observed that, sir, and I shall experiment in that line next season.

MR. EVELIN, of Santa Rosa: Has early or late pruning any effect upon the foliage coming out—whether by late pruning the foliage could not come out later than by pruning earlier. It would seem that if the cold nights are the cause of this trouble, that it might be benefited in some such manner.

MR. MOTHERAL: If you prune late, your vines bleed, and bleed profusely, especially if it is very late, and that always affects the vitality of the sap, and throws it back; but whether or not it can be done in such a way as to affect coulure I do not know, because there is nothing in the climate of this country that is regular—sometimes we have these cold nights later in the season, when the vines have grown several feet; we could not wait that long—sometimes it comes earlier; sometimes just as the plant begins to bud. This time it is irregular, you can't tell anything about it.

MR. EVELIN: I would like to ask Mr. Motheral if it is not considered an advantage to have the vine bleed some when it is pruned. I have understood it was.

MR. MOTHERAL: We used to have a good deal of nonsense, which we have abandoned. We at one time concluded that the black knot was the result of too much sap, therefore we pruned late; but I cannot see one particle of difference between the two.

PROFESSOR WOODWORTH: I think it would be well for us always to recognize that by naming this affection coulure we do not make a single disease of it. There are a great many things that are called coulure.



Coulure is a name for the falling of the blossoms, and it occurs in all countries and from a great variety of causes; in some places it is caused by mildew; in other places, like Fresno, it is caused by alkali, and I suppose there are any number of different causes in different localities. I am sure that a rain at a proper time might produce the result upon some plants, especially upon peach trees in the Eastern States. I would like to ask Mr. Motheral what evidence really there is that this alkali, which he finds upon the plant, comes through the plant. Doesn't that come through the air as dust, and light upon the plants that are wet with dew, and gather there? It is exactly the same in chemical composition to the dust that flies in the air.

MR. MOTHERAL: If Mr. Woodworth would look through a microscope as frequently as we have done, I think he would say it was not dust; if dust, it would not have that clear, transparent, crystal appearance. The dust down there is not transparent.

MR. WOODWORTH: I recognize that; but Mr. Motheral has already told us that it will dissolve in water. Now, if that is dust, whether it is clear or not, it will light upon the plant, and if it is covered with water I think that the salts will very easily dissolve, and then crystallize into these clear, shiny crystals.

MR. BLOWERS: I would like to make this statement: Anything that would destroy the proper balance between the masculine and the feminine in the Muscat, whether it is an excess of water, or whether it is a lack of water, or being a lack of moisture or a lack of honey, from being taken by the thrips, or dried up by the north wind before the pollen is ready to fertilize the plant—any of these causes will produce the same result. The small grapes are produced by the lack of fertilization; they drop when there is no fertilization, and there is no difficulty in tracing to its source the different causes, if they are properly watched and in time. In Yolo County a north wind, coming at a certain time before the pollen is ready to fertilize, the plant will crack the cap that protects the flower, and the wind will dry up the honey before the pollen is ready to fertilize the plant, and coulure, or dropping of the grape, is the consequence.

Recess.

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## XV.

### AFTERNOON SESSION.

Vice-President HERSEY in the chair.

#### ROOT KNOTS.

COLONEL HERSEY: I have an orchard afflicted with little knots on the roots; knots are the size of a hen's egg. If any person knows about it, I would like to hear from him in relation to it for a few minutes. It is getting to be something of a serious matter here, with myself at least, for I shall have to take out from thirty to sixty trees of the largest growth in my orchard. This knot may be found upon prune trees, apricot trees, almond trees, and peach trees—all of that class.

PROFESSOR SMITH, of Palo Alto: I will say that the root knot has puzzled the scientists of the United States for several years, and at this time the University at Berkeley, the Stanford University, and the Cornell University are all working upon it, as well as several scientists throughout the country, and every investigation is being made that possibly can be made by the scientific men, who notice the peculiarities of the disease and will report thereon.

COLONEL HERSEY: Is there any method of procedure advised so far as they have gone?

PROFESSOR SMITH: None whatever, and we know very little about it; we are not even satisfied whether it is the result of a fungous disease or of an insect.

MR. JACOBS: I know of an orchard where there have been root knots on the trees for several years, and this past season they have borne as well as usual. Of course, there are some few dying, but I don't really think that when it appears on the tree it pays to dig that tree up immediately. That it eventually kills the tree, I do not think there is any doubt. In nurseries on land that has been out in alfalfa, especially the first year after you break up the alfalfa, if you put in seedlings of any kind—it don't seem to make much difference what kind—the knots will be worse than on land that has been cultivated to other crops for years. I know of one large stock, this year, of not less than six hundred thousand. There was an alfalfa field plowed up last year and planted to peach trees largely; but I think there were about thirty-five thousand came from Myrobalan stock that I imported myself from France, and which appeared to be in perfect condition, and they are utterly ruined. I planted that same stock myself, a large quantity, and there is not a sign of it on my place. We suspect that it is a parasite or insect of some kind that feeds on the alfalfa roots. It is worse in that kind of land.

COLONEL HERSEY: Was that field pastured or cut for hay?

MR. JACOBS: It was pastured, and had been for years. And another one that was utterly ruined last year has been a pasture, to my knowledge, for seven years, and on that there was not a solitary plant, out of probably fifty thousand that I saw, that was not affected by the knot. One of those I refer to is near Farmersville, about eight miles from Visalia. There are two kinds of the knot—a common black knot, and also a small knot. Some of these knots are about the size of wheat grains, or white beans perhaps, and strung all along on the little white roots. There will be perhaps a space of a quarter or a half inch between them, so that on each plant there may be hundreds of those knots. They literally cover the root from end to end.

COLONEL McGLINCY: I have a neighbor who, three or four years ago, planted an orchard of prunes, and two years ago he found they were covered with root knot, and he dug up nearly all of the trees excepting a few. On those trees he experimented, by taking a knife and cutting off the knot as well as he could. On the cut he applied common salt. The result was the knot disappeared entirely, and those trees are growing finely. Had he made that experiment earlier, it would have saved him planting an orchard a second time.

## FRUIT VS. WHEAT.

## A Discussion of the Relative Importance of Wheat Growing and Fruit Growing in California.

By GEN. N. P. CHIPMAN, of Red Bluff.

At your annual convention held at Chico, in November, 1888, I read a paper entitled "Wheat vs. Fruit," in which I undertook to point out to the California agriculturist the increasing importance of fruit growing in this State, and why we should grow more fruit and less wheat. I am now requested to reëxamine the relative importance of the two industries in the light of later experience and more complete data. Whether we narrow the question to the simple inquiry as to which is the more profitable on a given number of acres, or take the broader view as to their relative influence on the future greatness and prosperity of the State, I think we shall easily reach the conclusion for which intelligent horticulturists of California have long contended.

The evolution of California has presented a series of surprises from the day when Marshall turned up the glittering nuggets in Sutter's mill-race and set the world ablaze with his discovery of gold. The growing of the cereals, and later of fruits, was as much a discovery as the finding of gold; and people were even more incredulous about the practicability and profitableness of tilling the soil than they were about making quick fortunes with the pick and shovel and rocker in the mountain gorges. Here and there, however, in the North and in the South, in the early forties, were to be found unmistakable evidences of what our climate and soil would do; but our people seemed not to admit the logic of facts or their own senses, and so they went on for years importing flour from Boston and New York, and fruits from Mexico and the islands of the sea.

Wheat growing took root at last in the fifties, but our eyes were not really opened to the possibilities of fruit growing until the profound movement began which has made Southern California a veritable Eden, and has incidentally uncovered new and untold wealth in the North in her fruit products. We had a surpassingly favorable climate, but we didn't know its commercial value, nor its true relation to the soil. And we are still unwilling to subject these two combined forces to their highest uses, as we evidence by keeping right on planting wheat that can be better grown in the icy regions of the Northwest; and we do this in the face of the fact that we send 70 or 80 per cent of it 15,000 miles to market, in competition with the whole world, and especially with our brothers of the Northwest, who only need to seek a foreign market for about 20 or 25 per cent. And, withal, California only exports about one tenth of our total exports.

## DIVERSIFICATION A NECESSITY.

I hold it to be a perversion of nature's gifts to use them contrary to their obviously higher and better purposes. In the old agricultural countries the farmer makes a careful study of adaptability of soil and climate to the growth of particular products. He selects his land for wheat, for corn, for oats, for barley, rye, grasses, and he rotates these crops as necessity requires. He plants the fruits and vegetables suitable



to the climate and soil, and if he is intelligent he always plants that which promises the richest returns. If he is in Dakota, he plants wheat; if in Kansas or Iowa, corn and wheat; if in North Carolina, rice and cotton; if in Louisiana, sugarcane; in France he grows prunes, in Spain raisins, and in Italy olives. He diversifies largely everywhere, but his staple is determined by the conditions of soil and climate.

Now, no one in the face of the facts will say that California is peculiarly adapted to wheat growing. A study of the productiveness of the wheat-growing regions of the Union will show that many States produce more to the acre than we do. The average gross yield per acre of wheat in California is less than 13 bushels, of the value of \$12 34 per acre, which was the result obtained in 1891—one of our best years.

#### VALUE OF WHEAT LANDS.

The average value of our best wheat land is not less than \$50. When we deduct from the gross product the cost of production, we have left less than an average of \$2 50 per annum per acre, out of which must be paid taxes and the repairs of implements and the farm kept up. Now, this is a summer-fallow crop, of which we get one in two years, and an added occasional winter crop once in three years. In exceptional cases much better returns are shown; but we must deal with general rather than exceptional results with wheat, as with fruit. I am authorized to say to you, by one of the best farmers in this State, who owns one of our best and largest wheat ranches, that his wheat land does not pay over 5 per cent per annum on the assessed value of \$50 per acre for the land.

I pointed out to you four years ago some of the disadvantages of wheat growing in California. Let me restate some of them briefly, with one or two added. We have a much smaller home market than our competitors in the wheat-growing States east of the Rocky Mountains. The United States exports about 25 per cent of all wheat grown; California exports fully 75 per cent of her wheat. Our surplus travels farther to market, and hence at greater cost, than any other wheat grown, except that of Oregon and Washington. We have no one advantage over our competitors to compensate this disadvantage. The water rates on wheat from Chicago to Liverpool are about \$3 50 per ton. The average rates for a period of years from San Francisco to Liverpool will not vary much from \$10 per ton. Assuming that the cost to Lake ports is about the same as to San Francisco from the farm, we have a difference in favor of the wheat growers of the West on his exported wheat of over \$6 per ton, or nearly 20 cents a bushel. But the wheat farmer near the centers of consumption gets a home-market price larger than the export price, while our home price is the Liverpool price, less cost of carriage.

#### THE WHEAT AREA UNLIMITED.

The "California Fruit Grower," one of the ablest trade and fruit journals in the State, recently pointed out, and fully proved, the statement that the wheat area of the United States can be expanded to meet any probable requirements for many years. It demonstrated what I have verified by examination of the reports of the Bureau of Statistics, that many of our Western States have curtailed their wheat acreage and devoted it to corn and other products found to be more profitable; but

they can easily shift to wheat when required. For example, Iowa had in 1891 in wheat 1,800,000 acres, while in 1875 she had 3,000,000 acres; Illinois had 3,600,000 acres planted in 1880, and only 1,900,000 in 1891. On the other hand, the capacity to rapidly increase production of wheat is shown in Kansas, where the acreage in 1891 ran up to 3,500,000, as against 1,600,000 in 1889, and 2,000,000 acres in 1890; Dakotas have increased steadily from 1,000,000 acres in 1883 to 4,800,000 acres in 1891.

I see no evidence of a decrease of wheat areas either in the United States or in competing foreign countries, so that the wheat grower need not look for better prices through any falling off in production, save in years of crop failures, unless the land is given over to other cereals, which is not likely to happen; and if it should happen can be given back to wheat when needed.

#### MORE WHEAT PER CAPITA THAN EVER.

Mr. J. R. Dodge, statistician of the Agricultural Department, in the report of that department for 1891, has furnished valuable facts and opinions resulting from his researches. In speaking of wheat, he calls attention to the fact that the population of the country is between three and four times as large as in 1840; the wheat crop of 1891 was seven times as large as in 1840; or  $4\frac{1}{2}$  bushels for each unit of population then, and  $9\frac{1}{2}$  bushels now. He says further: "There has been much written for twenty years past, the result of crude generalizing from agricultural data, to the effect that wheat growing is declining, moving westward, abandoned in the old States and precociously developing in the new. \* \* \* A little thoughtful review of the whole field of fact will show the kaleidoscopic changes incident to the work of diversifying and molding our primitive agriculture. Western New York produces as much wheat as ever, and fruit and vegetables and other products of ten-fold greater aggregate value. So do Ohio and Michigan."

He then shows how the yield of wheat may be largely increased by better methods; he cites the larger yields in the sands of Holland and the gravelly clays of England, and says that if our better soil were brought to the average yield of those countries, we would produce on the same area as now used a thousand million bushels. He then takes up the question of reserve and shows that the tendency is to underestimate; that the surplus of two or three years, held in remote regions not easy of access—in Russia and India and elsewhere—have been collected through improved commercial facilities and poured into the centers of trade, to the surprise of both consumers and producers, to the equalization of prices and the maintaining of relatively low rates throughout the world.

#### SINGLE CROPS RESPONSIBLE.

In speaking of the depressed prices, he refers the condition to the baneful influence of the single-crop idea.

Upon the question of the permanency of agricultural production, he presents some striking and valuable facts. He points out: that Europe, with four times our population, produces nearly enough subsistence for her own use; that all eastern Europe has a surplus, and that Italy's exports equal her imports; that the Netherlands, with only two and one half acres to each inhabitant, require only a few million dollars' worth

of agricultural imports in excess of agricultural exports; that France, with a population nine times as dense as ours, requires only about 7 per cent of her consumption; that even insular and factory-studded Great Britain feeds half her population from her own soil, through the labor of one eighth of her population, and the other half could be fed if the game preserves and pleasure grounds were utilized for agriculture; that it requires four times as much area here to feed one person as it does there, which it would be absurd to claim as a necessity.

He then shows, by incontestable proofs, that even in the States east of the Mississippi River land actually farmed is only partially utilized.

Upon the question of surplus he shows how easily possible it is to largely increase the output as the markets may demand, and that our wheat possibility is one of price and profit, and not of land and labor. He then submits tables to show that wheat growing in Europe is not declining. In his conclusions upon the subject he says:

"This country has not reached the limit of agricultural production; it has not even approached it. It is not true that the wheat of the world is declining. It is not difficult to prove the existence of 2,300,000,000 bushels as an average, and there is no prospect of decrease.

"The United States will continue to produce a surplus for export until the wheat culture of the United States shall have given place to more varied and profitable culture, and increasing numbers of non-agricultural population shall require for breadstuffs the entire crop." He adds:

"It is proper to say that the tendency is toward a better distribution of crops, and to higher prices and better profits. The proportion of agricultural labor will decrease, non-agricultural labor will increase, agricultural products will be more varied, rural intelligence and skill will advance, and the farmer will be in a better position to demand and secure an equitable share in the net proceeds of national industries."

If there is one lingering doubt in the mind of a California farmer, after reading carefully the report of the Agricultural Department for 1891, as to the plain path for him, I confess inability to reason from known data.

#### SMALL WHEAT FARMERS DRIVEN TO THE WALL.

It has come to pass in California that the more prosperous wheat growers must own or till large areas, and use steam and horse power, and dispense with men. The combined harvester has reversed the law of labor-saving machinery, and is depopulating the State. It came at the wrong time for California; and proved a boon to the large land holder, but a bane to the State.

I showed you in my former discussion of the subject, by incontestable evidence, that our wheat lands are not yielding so much per acre as they formerly did, and the four years have added strength to that point; that prices have gradually declined, while rates of transportation do not decline to meet the fall in prices, and this point still stands good; that the price is not likely to come back to former figures, because of the large wheat areas of the globe; that wheat growing cannot populate the State or increase its prestige and importance, or add to its wealth, and this point is more than verified by the fact that our wheat-growing regions are still sparsely settled; that we have reached the maximum of production; that many lands devoted to wheat are not profitable, by



reason of non-adaptability to that plant; and that much of the lands in wheat are specially adapted to fruit, and others are not, and should continue to be planted to wheat.

I showed that an intelligent application of ordinary sound judgment, in the light of facts everywhere apparent, should lead our farmers to devote their lands to wheat culture only where more profitable crops could not be grown; and that our output of other crops should be increased, and our wheat brought down to the necessities of our home market and those markets that can be reached with profit. I must be permitted to refer to the arguments then made and facts adduced, rather than to repeat them here.

#### NOT WHAT IT USED TO BE.

I need not incumber this paper with further additional proofs, to show that wheat growing is not what it once was here, and that it is no longer an attraction to the home-seeker of the East who is looking toward California. We can't sell our lands for wheat growing, at their true value, to Western wheat growers, who would have to exchange two or three acres for one, and leave more favorable conditions than exist here for his pursuit. We who believed in fruit talked to deaf ears when the farmer was getting 2 cents a pound for his wheat and was growing 25 bushels or more to the acre. Now, however, we ask him to look at his ledger and see if he cannot do better. He bought his land for \$5 to \$20 per acre. Our fruit industry has given it high value, and we want him to yield up his rich acres to the demand for higher and better uses.

President Andrews, of Brown University, says in the "North American Review" for November: "Only about one sixth of the cultivable land of the globe is yet occupied."

Let our wheat grower remember that wheat is the product of all lands and climes. Wherever man can live wheat will grow. Not so of the orange, the lemon, the fig, the prune, the olive, the raisin grape, the almond, the apricot, and even the pear or the peach—all distinctively California fruits. France obtains 25 per cent more wheat to the acre than we do, and English farmers obtain more than twice as much as we do. France reports 110,000,000 hectolitres, or over 300,000,000 bushels, grown this year, which is about three fifths as much as the entire crop of the United States.

#### SOMETHING WRONG IN FARMING.

It is not my province to criticise our methods; but there is something wrong in our farming, when France with an area only about one fourth larger than that of California, can, with all her other products, turn out three fifths as much wheat as the entire United States. It looks as though we were misusing the term *poor* when we talk about the *poor* farmer. We use it as an adjective of commiseration, when it should properly apply to him as an adjective of reprobation. They have been growing wheat in France and England for centuries, and the land does not give out for the reason that it is well farmed and kept replenished. We grow wheat till we exhaust the soil, and then move to a new region. I have a wheat-growing neighbor who, the other day, sold a thousand loads of manure for 10 cents a wagon load—the accumulation of years—and yet he told me with tears in his eyes that he would have to sell out

because his land wouldn't raise wheat like it used to. I need hardly add that it was an intelligent orchardist who bought the manure.

The point remains, that we have in the United States the fertility of soil, with good farming, to immensely increase our yield of wheat whenever it is needed.

#### OUR SUPERIOR CLIMATE AND SOIL.

What is it that gives value to California land? It is not richness of soil alone, for Kansas and the great Northwest have the fattest land in the world. It is not in the profitableness of our cereal crops, for our grain farmers will testify that they are not making money. What, then, is it? It is the adaptability of climate and soil to the production of the most profitable fruits of the earth.

But California is not to be built up by her climate alone, for mankind cannot exist on climate. The State is not to be built up by the richness of soil alone, for men will not go thousands of miles and pay more for land than land equally fertile will cost near home.

The solution of California's future greatness lies in the success of the efforts which this State Board of Horticulture has been so patriotically making for the past ten or fifteen years. The day will come when all Californians will honor above all others the men who founded this society, and who have so faithfully promoted the growth of horticulture through its efforts.

#### CALIFORNIA'S EXTENSIVE CAPABILITIES.

And this brings me to the easy and pleasing duty of showing what has lifted California to her high plane of promise, and why California to-day offers such unexampled inducements to the home-seeker, and why fruit is more profitable than wheat.

For nearly or quite 700 miles, from Shasta to San Diego, and wherever the elevation is not greater than 1,500 feet (and in places over 2,500) lies a great empire, with all the gifts of nature that the Giver of all good has so bountifully bestowed upon France, Italy, and Spain. The lines of equal temperature that sixteen years of daily official observations of the Signal Service Bureau, and later the Weather Bureau of the United States, have traced upon the map, are incontestable records of our wonderful climate. The line marking 35° above zero, minimum temperature for the year, starts on the Pacific coast near Cape Mendocino, and runs through the valleys near Los Angeles, down to San Diego, and disappears in Mexico, and emerges on the Atlantic coast at Cedar Keys, Florida, 600 miles farther south than where it started. The zero line starts on the Atlantic coast near New Haven, Conn.; runs through St. Louis, Santa Fe, Prescott, Arizona, and then turns north and enters British Columbia east of Spokane, Washington. The lines of 5°, 10°, 15°, and even 20° above zero, starting at various points on the Atlantic, from about Sandy Hook down to Hatteras, run across the continent and into British Columbia, without reaching any of our low altitude valleys from Shasta to San Diego. The minimum line of 25° above zero passes east of Red Bluff, a little east of Visalia and Riverside, runs into Mexico, and appears again at Wilmington, N. C.

While we are pruning, planting, and working in our orchards and putting in our winter-sown grain in January, the thermometer marks

14° below zero in Chicago, 31° below at St. Paul, and 39° below at Bismarck, Dakota. While we are shipping our late green fruits in November, the thermometer is playing with zero at the points named in the West.

These are striking differences, and they are what give the high value to California homes and California agriculture.

#### INCREDIBLE RANGE OF PRODUCTS.

The region to which I have referred lying west of the Sierra embraces 20,000,000 acres, where may be grown every product known to the map of all Europe. The range of products that lies between the date palm and the hardy apple is prodigious. It exists nowhere in any one country on God's footstool except in California. Within that range lies greater wealth than it has yet entered into our minds to conceive.

#### WEALTH IN OLIVES.

Consider that precious fruit, the olive. The most accomplished agronomists accord to California all the favorable conditions existing in Italy for the growth of this valuable fruit.

Italy produces annually 70,000,000 gallons of olive oil. The market value of this oil, in Italy, is not less than \$120,000,000, and that is more money than the value of all the wheat exports of the United States for 1891.

The precocity and fecundity of California soil and climate are strikingly exhibited in the olive. I am told that it takes ten or fifteen years to bring the olive into profitable bearing in Italy. Our distinguished President, Mr. Ellwood Cooper, obtains ten bottles of oil from seven-year-old trees, and every bottle worth a dollar.

So wise and far-seeing a man as the senior Senator from California is quoted as saying that olive culture has been killed by the substitution of cotton-seed oil for the genuine article. I must doubt the authority of any one to commit Governor Stanford to that statement. I would as soon expect from him the opinion that oleomargarine would kill the dairy business, or that effervescent cider would displace champagne. We eat the cotton-seed oil because we cannot get pure olive oil, and not because of its cheapness or because it is satisfactory. When our olive orchards are able to supply the demand, and we compel the cotton-seed oil to put on the brand of its ignoble origin, and take off the lie which sells it, we shall see very few people dressing salads with the spurious article.

The possibilities of the olive in California are little appreciated. So much is already known of our citrus and our deciduous fruits, that I must be pardoned if I emphasize the importance of greater attention to the olive.

Happily we have the highest and most conclusive evidence in the archives of our society, albeit they have been overlooked in the mass of other valuable matter that enriches our annual reports. When the olive was under discussion at one of our conventions (see Report of 1887-8), Mr. Ellwood Cooper took the witness stand. His testimony will be accepted with the same faith that would be accorded to the evidence of our most eminent citizen. I quote:



"I have growing on my place olive trees in the black adobe, in deep bottom land, in sandy land made from the wash of the mountains, on stony hillsides and adobe hillsides, and on table land where the subsoil is probably twenty feet deep, dark clay; and so far as I have known, there is no difference in the bearing of these trees or in the oil made." As to quantity produced, he says: "The only test I have ever made as to the quantities borne by an orchard—that is, taking all the trees—showed one hundred and twenty-two pounds of olives throughout the orchard—large trees and small—seven years old *from the cuttings*. The best result in making oil has been  $10\frac{1}{2}$  pounds in one large bottle; the poorest result was  $12\frac{1}{2}$  pounds. We have from the tree seven years old at least ten bottles of oil; and those bottles will sell readily anywhere and everywhere at \$1 apiece. I was compelled to put up the price to \$2—\$24 a case—to keep my customers from quarreling about it; and I am sorry to say they quarreled about it just the same. As soon as I have enough I shall put it back to \$12 a case. One dollar for a large bottle of oil is profit enough for an olive orchard."

At the convention held at Chico, the Hon. Charles Dondero, of San Francisco, a consular representative of Italy, presented a most valuable paper upon the subject. He was born among olive groves, and brought with him to his new home a love for this precious tree amounting almost to adoration. I quote from his admirable and exhaustive address before the Chico Horticultural Convention, November 22, 1888. He says:

"There are no two countries in the world so similar in topographical conformation, position, climate, and agricultural products as Italy and California. The olive is justly considered the Providence of Italy. It was undoubtedly cultivated there before Cassandra's prediction on the fate of Troy—before Homer had immortalized the wrath of Achilles. According to history, the great olive trees yet seen around Tivoli, whose gigantic forms rival the majestic sequoias of the Sierra, were already old when Romulus traced with a plow the walls of Rome. Since then mighty rulers, powerful empires, bright and barbarous civilizations, have arisen and disappeared; but the olive giants, untouched by all vandalic invaders, respected by the hurricanes of thirty centuries, are there, covering nearly an acre of ground each, vigorous and productive as in the days of Christ. The average duration of this tree, however, is considered two hundred and fifty years—long enough for us all. Its production increases until the age of forty or fifty. It remains then about the same from year to year, if properly managed, with a perceptible improvement in the quality of the oil.

"Italy," he says, "produces more olive oil than all other countries combined—France, 1,250,000 gallons; Portugal, Algeria, Tripoli, Egypt, Greece, Dalmatia, and some other countries, 18,000,000 gallons; Spain, 15,000,000 gallons; Italy, 70,000,000 gallons."

#### THE OLIVE IN ITALY

Speaking of Italy, Mr. Dondero says:

"An olive grove in that country constitutes the luxury of the wealthy, the resource of the poor, the blessing of all. Polenta (a cornmeal mush), with olive oil and wine, is the most substantial noon meal of millions of hard-working Italians. It is due to the providential olive oil that Italy never had to suffer during the appalling pestilences and barbarous inva-

sions of the Dark Ages, or at any other ancient or modern period such fearful famines as other countries had. Garibaldi and his fearless followers would not have won the desperate battle of Milazzo, and broken the chains of tyranny to eleven millions of people, if the providential oil had not saved them from starvation. It lingers yet in my memory, a saying of my grandmother, at the time when the rapacious legions of the first Napoleon on one side and the cruel Austrian hordes on the other were desolating her home and olive plantation: 'Children, as long as we have in the wall-pit a sack of bran and a jar of oil, God is with us and our country.'"

It is difficult to conceive how great would be the increase of wealth to our State by the cultivation of this fruit alone. Assuming Mr. Cooper's results to be obtainable, one acre out of every five hundred acres adapted to olive culture in this State would produce more in value than all our wheat exports.

#### VALUE OF THE ORANGE.

How long is it since we found commercial value in the orange? It seems but yesterday. And yet Southern California has been enriched by the discovery. In 1891 they received \$1,796,000 for oranges alone, and this from a comparatively small acreage. Riverside shipped fifteen carloads in 1880-81, and in 1889-90 she shipped one thousand five hundred carloads. Both olives and oranges are now grown in commercial quantities at points six hundred miles apart north and south. In Tehama and Butte Counties—latitude corresponding with New York City; and in San Diego—in latitude corresponding with Charleston, South Carolina—these fruits are found. Practically parallels of latitude are non-existent as indicating temperature.

#### RAISINS AND PRUNES.

Our raisin and prune industries are examples of what may be done in California fruit growing. The rapid growth and development of Fresno County is directly traceable to the raisin. In 1880 her population was 9,478; in 1890 it was 32,026. In 1880 Fresno City had a population of 1,112; in 1890 it had increased to 10,818, or 872 per cent. Fruit growing did this. Would this magic-like transformation have happened if fruit trees and vines had not been planted? Would this all have happened if fruit growing had not been profitable? Fresno is an interior city about ten hours by cars from San Francisco, and has no water communication. There was nothing especially attractive in soil or climate above a hundred other places in Northern California. Nothing but the logic of rich rewards to the horticulturist gave Fresno her prestige, and nothing now can ever rob her of it. Her destiny is assured. But this is only a type of California's productiveness to be found elsewhere in the State.

After the fruit crop of 1890 had all gone into market, I undertook to verify the belief of fruit growers that their exports equaled in value the exports of wheat. The claim was ridiculed as preposterous. The wheat grower felt himself aggrieved, and his occupation belittled. He never stopped to think that we had gone along with our pottering business without taking away his wheat lands from him, and had added wealth to the State without taking away a dollar, and that he could afford to

be just to us if he did pity our folly. And so I set about gathering the facts which I afterwards embodied in a detailed report to the State Board of Trade. The result was an unexpected victory for fruit, and showed that our fruit and wine exports for that year reached \$19,857,826, while wheat and flour exports fell short \$530,660.

#### ENORMOUS VALUE OF FRUIT PRODUCTS.

It is due to the completeness of our records that the comparison should be given in this paper. It is as follows:

##### *Fruit Exports.*

Green deciduous fruits, 68,084,124 pounds, at 2½ cents	\$1,702,103
Dried deciduous fruits, 64,595,181 pounds, at 12½ cents	8,074,397
Raisins, 41,120,330 pounds, at 6½ cents	2,570,020
Nuts, 1,574,230 pounds, at 10 cents	157,423
Canned fruits, 80,121,950 pounds, at 3 cents	2,403,658
Oranges, 1,028,700 boxes, at \$1 75	1,796,025
Grapes, in wine, 18,000,000 gallons, at 15 cents	2,700,000
Grapes, in brandy, 1,000,000 gallons, at 45 cents	450,000
	<b>\$19,857,826</b>

##### *Wheat Exports.*

Wheat	21,699,683 bushels.	
Flour	5,910,555 bushels of wheat.	
Total	27,610,238 bushels, at 70 cents	<b>\$19,327,166</b>
Excess value of fruit		<b>\$530,660</b>

Let us turn back a decade. In 1880 we exported 3,141,500 pounds of green fruit and 412,480 pounds of dried fruit, besides our raisins and canned fruit. Little wonder is it that the contemptuous beginning of 1880 had moved the wheat growers to pity for the misguided fruit grower. And yet in ten years we added \$20,000,000 annually to the wealth of the State, without diminishing the possibilities of wheat growing by so much as a bushel. Indeed, our wheat output for 1891 has never been but once before equaled.

#### NORTHERN AND SOUTHERN PRODUCTS.

In that same report was another instructive table that deserves an incidental place in our records. It shows what part of that fruit went from Northern California and what from the South. It is as follows:

	North.		South.	
Dried	38,524,900 lbs.	\$4,815,613	26,070,281 lbs.	\$3,258,785
Green	67,080,834 lbs.	1,675,771	1,053,290 lbs.	26,332
Raisins	25,595,330 lbs.	1,599,705	15,525,000 lbs.	970,312
Canned	77,413,020 lbs.	2,322,390	2,708,930 lbs.	81,267
Nuts	356,510 lbs.	35,651	1,217,730 lbs.	121,772
Oranges		4,200		1,796,025
Wine	16,000,000 gals.	2,400,000	2,000,000 gals.	300,000
Brandy	800,000 gals.	360,000	200,000 gals.	70,000
Total North		<b>\$13,213,330</b>	Total South	<b>\$6,644,493</b>



## DIFFERENCES IN THESE REGIONS.

Some deductions drawn are worthy of repetition:

"It will be noted that green deciduous fruits are nearly all shipped from the North; that shipments of dried fruit from the North exceed those from the South over 11,000,000 pounds; that five eighths of the raisins go from the North; that nearly all the canned goods go from the North; that of the wine and brandy, eight ninths go from the North; that nearly all the nuts, and, practically, all the oranges, go from the South. It will also be noted that the green deciduous fruits exported from the State about equal the value of oranges; that the dried fruits are more than four times the value of oranges; that our raisins have a value of nearly \$1,000,000 more than oranges, and our canned goods more than \$500,000 more than oranges; that our wines and brandies have a value to the producer of \$1,250,000 more than oranges. Also, that the exports of deciduous fruits and nuts exceed exports of oranges by \$17,000,000. It will also be noted that the value of the dried fruit shipped from the South is about double the value of her oranges; that the raisins of the South equal half the value of the oranges, and that the orange crop of the South is only about one fourth in value of her whole fruit crop."

I have tried by every mental process at my command, and on many occasions, to emphasize and make clear the great value and attractions of our developed fruit regions. I never weary of this effort, for I feel my conscience as clear in helping to establish new homes in California as the most zealous missionary ever felt in leading the benighted heathen into the New Jerusalem.

The one thing that I cannot understand is, that we have not five million population, instead of one and a quarter million.

## VALUE OF SANTA CLARA VALLEY.

Did you ever try to figure out what the Santa Clara Valley would sell for, if it could be picked up and set down with all its advantages of climate and soil as we know them, within, say, one hundred miles of the city of Chicago? The Happy Valley of Rasselas, the Vale of Cashmere, the home of the Peri, and all the other poetic conceptions of all the centuries, have never pictured anything more charming or more valuable than that would be. Every acre would be worth a small fortune. And yet I can conduct you to a hundred places in Northern California equally attractive, where the owners are blindly misusing the soil and squeezing out the last remaining elements of fertility to grow a crop that barely pays cost of production. To my mind it is not less senseless than would be the miner, who would clean up his sluice-boxes and save the pebbles and let the gold go down the gulch.

If you agree with me that the beautiful Santa Clara Valley set down in Illinois would have incalculable value, tell me why it has not approximately that same value here, only four days' ride from Chicago?

## WORTH \$1,000 AN ACRE.

If Mr. A. T. Hatch's Suisun orchard could be set down in Iowa, with all its delightful surroundings and all its exuberance and wealth of fruits, would anybody hesitate to pay \$1,000 an acre for it? Can you

give me a satisfactory reason why it may not be nearly as valuable here—not for wheat growing, but for prunes and peaches and almonds and pears—in short, for California fruits?

#### FRUIT GROWING SUPREME.

I am endeavoring not to depart from my purpose, which is to exalt fruit growing to its well-earned supremacy. If I appear to diverge it will be seen that it is only to give you a fresh view-point. What the fruit grower has unselfishly labored for in all these years has been, and is, to build up a great and powerful commonwealth, by planting industrious families on many of these unpopulated, monotonous, dreary, and unprofitable wheat fields and waste places; and convince their owners that when the Creator selected California as the only place on His footstool where every fruit of every zone might be grown, He intended that we should supply the wants of the teeming millions who were to dwell on the American continent, and he didn't mean that these matchless gifts were to be prostituted to ignoble and profitless uses.

#### FRUIT VERSUS WHEAT.

The "Rural Press," one of the most watchful guardians of our agricultural and fruit interests, in a recent issue endeavored to console the wheat grower with the hope of getting \$1 50 for his wheat if he would hold a little longer, basing the argument upon the narrow margin of reserves now in store. That very able financier and public-spirited citizen, Mr. Albert Montpelier, was called to the witness stand to support the hypothesis. I hope they are right, and I wish the wheat grower could get \$2 for his wheat. But would Professor Wickson or Mr. Montpelier counsel wheat growing as against fruit growing in California? Certainly not; and for the obvious reason that they both fully realize how vastly more important and more profitable fruit growing is than wheat growing.

Indeed, it may be conceded that wheat may be grown here at a profit, but the fact still remains that fruit is more profitable than wheat can possibly be under any conceivable conditions.

But what evidences have we that these twenty millions of dollars received from fruit in 1890 produced more profit to the fruit grower than the wheat grower got for his wheat, and what evidence that fruit growing is doing what we claim for the State?

There are many ways to prove this. One very effective means is to take localities where fruit growing has become a leading industry, and compare them with those localities where the change to fruit has not become marked.

I need not refer to all the counties where the evidence exists; a few will serve the purpose. The proof rests upon the concurrence of two facts, namely: increase in assessed valuation and increase in the population.

I will take five counties in which fruit growing is a distinctive feature:

County.	Population.		Assessed Value.	
	1880.	1890.	1880.	1890.
Los Angeles.....	33,381	101,454	\$16,368,649	\$69,475,025
San Bernardino.....	7,786	25,497	2,576,973	22,410,440
San Diego.....	8,618	34,987	3,525,258	30,118,503
Fresno.....	9,478	32,026	6,354,596	36,110,343
Santa Clara.....	35,039	48,005	27,603,240	53,193,579

In population, Los Angeles gained 203 per cent; San Bernardino, 227 per cent; San Diego, 305 per cent; Fresno, 237 per cent; and Santa Clara, 37 per cent; and the increase in valuation ran along *pari passu*.

Now, let us consider four wheat counties:

County.	Population.		Assessed Value.	
	1880.	1890.	1880.	1890.
Colusa.....	13,118	14,640	\$12,440,380	\$20,669,809
Butte.....	18,721	17,939	10,743,426	15,839,385
Tehama.....	9,301	9,916	4,199,998	9,121,975
San Joaquin.....	24,349	28,629	17,377,129	32,080,117

Colusa gained in population 11 per cent; Butte lost; Tehama gained 6 per cent, and San Joaquin gained 17 per cent.

#### WHEAT A POOR ATTRACTION.

It is the proud boast of Colusa that she is the largest wheat-producing county in the world. She has gained 1,522 people in ten years. But what profiteth it the State that she has broad acres of wheat and no growth of population?

Compare San Joaquin and Fresno. The former is a great wheat-growing county, and has not yet developed fruit distinctively. Fresno raises a large amount of wheat also, but has developed fruit largely. Of the two counties, San Joaquin is the more favorably situated as to transportation facilities, and in all respects is equal to Fresno, and they lie near each other, with much the same condition of soil and climate. Fresno has increased 230 per cent in population, and San Joaquin only 17 per cent. San Joaquin has added 4,000 population in ten years, while Fresno has added over 22,000.

If you will study the drift of population in the valley regions of the State you will find it has gone to the fruit-growing counties almost entirely, and thus confirming what we say, that fruit, and not wheat, is to build up California.

I take no pleasure in pointing out to you another remarkable contrast between these two imperial counties. But we are after the truth, and often nothing but the truth will awaken, and must be spoken, however unpleasant.



## SAN JOAQUIN COUNTY.

San Joaquin County, in 1880, had residing in towns and in the city of Stockton, 11,822 inhabitants. In 1890 she had increased her urban population to 17,730 inhabitants—a gain of 5,908.

The total gain in the ten years for the whole county was 4,280, which is 1,628 less than the gain in the towns and cities; and this means that there is an actual loss of rural population of 1,628 in ten years, when there ought to have been a gain, and would have been, in my belief, a gain of 8,000 or 10,000, if water had been brought on to the parched wheat fields, and the land surrendered in greater part to fruit. Stockton alone has received four fifths of this gain, and is a lusty and very promising city; but how much stronger it would be with 10,000 more people pouring their wealth into her coffers.

Now turn to Fresno County. In 1880 there resided in the towns 1,417 inhabitants. In 1890 they had increased to 13,635—a gain of 12,218. The total gain in ten years for the whole county was 22,548, which is 10,330 more than the gain in the towns, and this means 10,330 added to the rural population. Fresno added in ten years to her rural population more people than were in the county in 1880, while San Joaquin went back and lost 1,628.

Precisely the same thing has happened in Colusa, and Butte, and Tehama, and other counties where wheat is the staple, the rural population has fallen off.

This emphasizes in the strongest possible manner the point I am making, and should awaken the solicitude of our people.

## IF NOT FRUIT, THEN BABIES.

I must not be blamed for this diagnosis. I may be wrong in my remedy, but I am right as to the disease. Let me say to San Joaquin, in all truth and soberness, as I am constantly saying to my own county, there is something wrong. Your broad, rich, and beautiful acres should have more people instead of less after ten years that have added nearly 40 per cent increase to the rest of the State. If you won't take our advice and plant more fruit, at least try and raise more babies.

But I am not through with the wheat grower. It will be observed as a mark of prosperity among fruit growers, compared with the conditions present among many of the wheat ranches, that an atmosphere of thrift and comfort, and even luxury, surrounds the orchard regions, while the wheat grower is content with the same roof that sheltered him twenty years ago, and his hired men continue to roost in the hay mows, and migrate after harvest and disappear with the meadow larks, to reappear from God knows where the following season.

## LAZY MEN NEED NOT APPLY.

A slothful, or lazy, or unambitious man has no business with an orchard. He must be observant, industrious, intelligent, a reading man, and he must have to some extent the mercantile faculty. The wheat grower cannot make his market; it is made for him. The fruit grower can make his market by superior cultivation and care of his orchard and handling of his product. His calling develops his higher faculties and makes of him a superior citizen.

Again, the products of the orchard will bear all-rail transportation to the centers of consumption, while wheat can go only by water. Our fruit may be shipped green or dried, and still yield profit, and it is a question in which form it is the more profitable. We thus have the markets of the world, while our wheat has but one point of consignment, and that 15,000 miles away. Our green and dried fruit may now be placed in Liverpool in fifteen days, while our wheat takes four months; and the farmer must bear all the cost of this delay in reaching the consumer. And this item alone means half a year's interest on all his crop. Again, there is more certainty in the fruit crop than in the wheat crop, while prices are at least equally staple. Again, a family can well be supported on ten acres of fruit, and upon less invested capital than in wheat culture. A family can produce more in pounds and in value on 10 acres of fruit than on 150 acres in wheat. This is easily demonstrable.

Ten thousand pounds of green prunes per acre, or 3,330 pounds of dried, is a conservative estimate. Twenty bushels of wheat, or 1,200 pounds, is a large estimate per acre. The farm value of the prunes this year is \$330. The farm value of the wheat is \$15. Our peach orchards will show as many pounds green as of prunes, with half the dried product of prunes, worth this year \$200 per acre.

We have low prices for fruit at times, but never down to cost of production. There never has been a time when good fruit, well handled and cured, did not bring a good profit.

There is in fact but one question that admits of discussion bearing upon the fruit industry of California? We have advanced beyond the experimental stage in all fruit products of the State from Shasta to San Diego. Oranges, lemons, figs, almonds and other nuts, prunes, cherries, apples, peaches, apricots, pears, plums, nectarines, olives, and foreign grapes, are all grown in commercial quantities for 700 miles north and south. Our trees come into bearing quickly, are prolific bearers, are long lived and healthy. The fruit is large and bears shipment green for long distances, and retains much of its lusciousness, and flavor, and attractive appearance.

#### NO DANGER OF OVER-PRODUCTION.

The sole factor that has not passed beyond dispute relates to the question of over-production, and consequent loss of market. We had this confronting us in 1880, when we exported by rail only 546 carloads, and we had it in 1891, when we shipped 20,706 carloads, including shipments by sea. Strangely enough, there are fewer persons now who doubt the market than there were in 1880, although we export forty pounds now where we shipped one then.

There is one very convincing fact to my mind that the danger of over-production is imaginary. It is this: Our horticulturists are deeply interested in the question; they are, as a class, reflective and intelligent—I think I may truthfully say, a very superior body of men. Their interest and success are deeply involved in knowing the truth of the matter; they are not land agents, and few of them have land for sale. Every personal consideration would lead them to discourage planting, if they thought there was any danger of over-production. But they not only do not discourage, but are doing all they can to encourage it, and are extending their own plantings where they can.

Mr. W. H. Mills, a high authority upon the question of distribution, has recently pointed out the fact that our fruits do not reach over 5,000,000 of our citizens out of the 65,000,000 who will buy them if they can get them.

We shipped by rail to the East in 1891 of green fruit less than three pounds per capita of our population; of dried fruit one pound per capita; of raisins about two thirds of a pound per capita, and of canned fruits about three fourths of a pound per capita—about five and one half pounds per capita of all kinds.

It must be obvious to all that this is only tasting fruit—not eating it. But our population is increasing at the rate of over one and a half million people annually. It will take a thousand acres of new orchards every year to keep pace with this increase alone at the present small per capita consumption. If, however, our fruit is consumed by five million people, they must buy one hundred pounds per capita, which shows our utter inability to over-produce when we shall have reached all the consumers.

#### OUR MARKET GROWING.

President Andrews, already quoted, says: "Our own country, adding to its numbers by nearly 3 per cent a year, bids fair to approach ninety millions by 1900."

Think of thirty million people to be added in eight years; it is simply appalling; and California must supply them with fruit. Does it not seem more of a problem whether we can do it, even by our rapid planting, than whether we can find purchasers?

But we must not overlook another important fact, that this increase of human beings will not gather along the Atlantic coast. They will push into the great West. The center of population is moving steadily westward. The census of 1890 shows that nearly one half of the increase since 1880 has been west of the Mississippi River. We read the large figures of shipments of our green fruits and think them phenomenal, and hence conclude that we must necessarily glut the market shortly. You will be surprised to know how small a figure our green fruit cuts at the East. A copy of the proceedings of the Western New York Horticultural Society for 1886 came into my hands. Nineteen counties were represented, but only nine gave data from which I could calculate shipments of fruit for 1885.

I found, however, that the nine counties had shipped 387,558,820 pounds of apples that year to a market near home.

Now, California has never sent out in any one year more than half this number of pounds of green deciduous fruits and oranges; indeed, our entire export of green, dried, and canned fruit by rail and by sea in 1891 fell short of the number of pounds shipped from nine counties in the State of New York, in 1885. The total yield of apples from this region in a good year would probably reach 40,000 carloads.

#### DON'T HAVE TO WAIT LONG YEARS.

Let me tell you another thing which may comfort those who doubt the profitableness of fruit growing. Orchardists in Western New York claim to make a net profit of \$200 to \$300 per acre. A four-acre orchard planted in 1833 was reported as yielding \$400 per acre. Another orchard



bore its first good crop after twenty years. In Monroe County an orchard nineteen years old reported \$400 to the acre. And yet our Eastern brethren accuse us of violating the ninth commandment, when we tell them we get \$200 or \$300 per acre from our orchards, while the fact is we suppress the truth, which is that we often get twice that; and we don't have to wait twenty, or ten, or even six years.

At the risk of pushing the argument beyond reasonable limits (for the question of our ability to sell our fruit is certainly an important one), I must give you another illustration. I have carefully inquired to learn the consumption of fruit by a family of five here in California, and I find that it consumes throughout the year, in all forms, an average of one pound per day, or seventy-five pounds per capita for the year. California now consumes 25 per cent of all we grow, and our State only contains about one fiftieth of the population of the Union. We consume per capita—and we pay good prices for it—seventy-five pounds of our fruit, while we are selling without the State only five and one half pounds per capita of all kinds.

I am utterly unable to turn the light upon this question from any direction without seeing a practically unlimited market.

The "California Fruit Grower," of November 5th, publishes an extract from a letter written to the "Southern Cultivator," relating to the Georgia peach. The claim is made that the Georgia peach growers realize a profit of \$150 to \$300 per acre, and some valuable facts are given to justify the claim.

They pack in cases of six one-gallon baskets, weighing about forty pounds in each case—500 cases to a carload. The freight to New York is 35 cents per case, or \$175 per car; refrigeration, 18 cents; making 53 cents per case in all, or \$265 per car. The cases are set down as costing 24 cents made up; picking, packing, and hauling to the railroad, about 10 cents more, making 35 cents f. o. b. cars. The correspondent further states that a carload of good peaches usually nets the grower about \$1,000. He further reports sales of 480 cases by Snow & Co., of Boston, in August, when Delaware and California peaches were in the market, at \$1,721 75 gross. Allowing usual commissions, it will be seen that \$1,000 per car net to the grower was an inside estimate.

We ought not to be obliged to make affidavits about our profits when the New York apple grower and the Georgia peach grower claim an unchallenged profit of \$200 to \$400 per acre. You will observe that the transportation cost from Georgia to New York is greater than ours from here to New York.

No one can doubt the superiority of the California fruit orchard for certainty of crop, quantity and quality of fruit. Why, then, should any one doubt the profitableness of the industry?

Mr. Mortimer Whitehead, Special Agent in charge of Division B of Agriculture of the Eleventh Census—which includes Horticulture—at a meeting of the American Pomological Society in 1891, stated that the peach acreage in the United States was found to be 597,736; the value of the product, \$76,160,400; and that over \$90,000,000 were invested in peach growing in the census year of 1889.

Here is evidence that the American people expend about \$1 25 per capita per annum for peaches alone. It is also evidence showing that the peach orchards as a whole yielded about \$130 per acre. Large as is the peach industry, it is less than one tenth of the whole fruit industries.

Mr. Whitehead stated that the investment in horticultural pursuits will be shown to be more than \$1,000,000,000.

Surely the humble fruit grower may now claim the right to stand beside the noble army of agricultural toilers, whose mission has been to supply the world with articles of food necessary to human existence, and whose calling has been the theme of poets, the care of statesmen, the solicitude of governments, and always will be, as it always has been, regarded as the basis of human progress and human happiness.

#### THE REAL PROBLEM.

The truth is, that the problem with us is one of transportation and distribution. And this involves the problem of bringing the producer and consumer nearer each other. We are content with  $1\frac{1}{2}$  cents per pound for almost any of our green fruit. It will afford a good profit at 1 cent. Add  $1\frac{1}{2}$  cents for carriage, and 2 cents for the middle men and for packing, and we have California fruits in the hands of consumers at 5 cents per pound, and this means a three-ounce peach for a cent, or a dozen apricots for a nickle, or three large Bartlett's for a dime, or a nice dish of fruit for a family for a quarter. We all know that people will eat fruit in quantities at reasonable prices. The whole solution of the question rests with us in improving and cheapening transportation costs, and not giving the lion's share to the middle men.

#### FIFTEEN DAYS TO LONDON.

A new and important factor has been introduced in the demonstration that our green fruits can be laid down in good condition in London, and Paris, and Hamburg, in fifteen days. Our dried and canned fruits are also being well received abroad, and this will add immensely to our markets. I think I need not pursue this point further. Many are deterred from engaging in fruit culture, because of the time consumed in building an orchard; because of unfamiliarity with the occupation, and because of the cost.

Now, let us look at these objections a moment. Given the land (which can be bought for from \$25 to \$200 an acre, and if you are content to start in newly developing regions the cheaper land will be found just as good as the dear)—I say, given the land, you can have a paying peach, or almond, or apricot orchard by omitting one summer-fallow crop of wheat; in other words, in four years; in five, a paying prune orchard, and in six, a paying pear orchard. You will get fruit sooner, and considerable of it. From this time each year adds to the value.

#### NO MYSTERY IN FRUIT GROWING.

As to your unfamiliarity with the business, you have only to study the methods of successful growers around you and apply the ordinary rules of soil tillage and your good, sound, common sense, and nothing more. There is no mystery in the art of fruit growing.

As to the cost, you must consider your investment and its character and value. You sow wheat, and put seven or eight dollars into the ground, and in two years take away twelve or fifteen at most, and must

then repeat the process. Every planting is a new investment and a new venture.

You plant an acre of trees and they will cost you at the end of the first year \$30, which you can reduce to \$25 by your own labor; at the end of the second year you will have paid out \$10 more per acre; the third, \$12 50, and the fourth, \$15; in four years, \$67 50. If you have had some bad luck, you may add enough to make \$75 per acre, or possibly \$80.

The fifth year of apricots, peaches, or almonds you should have a gross income of \$150 per acre, at least half of which should be profit.

The same acre in wheat would have given you two crops in the four years, yielding you a profit of \$15, which is far more than the average, and you will probably get one volunteer crop, making \$20 in all. But at the end of the fourth year you have nothing but the land less productive.

In the case of the orchard, you have built a permanent plant that needs only care and tillage, with an increasing income, and greatly disproportionate to the income from wheat.

Viewing the matter from the standpoint of interest on the investment, and there is increasing advantage in the orchard.

I think fruit growers will corroborate my statement that I have underestimated the orchard and over-stated the wheat field.

#### DO NOT ABANDON WHEAT GROWING.

I leave the subject with one or two observations. As fruit growers, we do not counsel the abandonment of wheat growing in California by any means. We only say that much of the wheat land should be subdivided and placed in the hands of more people, and subjected to higher and more profitable uses; that our soil and climate are adapted to the growth and production of many valuable fruits that cannot be elsewhere grown in the United States, and that we can find a much more remunerative market than our wheat can ever find; that profitable fruit growing means small holdings and increased population, and a better home market for wheat; that one acre in fruit will yield more profit than fifteen acres in wheat; that fruit growing is a higher order of agriculture, develops a more thoughtful and intelligent man, and conduces to better citizenship, by reason of this higher intelligence; that it will tend to hold our children away from the cities, by making rural life more attractive. In short, it will add to the happiness of the people, and wealth and power and prestige to the State.

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#### VOTE OF THANKS.

On motion, a vote of thanks was tendered to General Chipman for his able essay, and for his presence at the convention.



## THE TEN-BLOCK SYSTEM OF NUMBERING COUNTRY HOUSES.

By A. L. BANCROFT, of San Francisco and Contra Costa County.

*A Short Explanation.*—The roads of an entire county are arranged in as long lengths as practicable and are all named. They are then measured, commencing at the county seat or at the end nearest to it, and each mile is divided into ten equal parts or imaginary blocks, having frontage only. Two numbers are assigned to each block; one to each frontage, the odd ones upon the left and the even ones upon the right—ten blocks to a mile; twenty numbers to a mile. Any house having an entrance in a block has the number of that block. The number for all but the first house in a block is followed by a distinguishing letter—742, 742a, 742b, etc. Divide the even numbers by two and point off one decimal, and the distance in miles and tenths, from the commencement of the road, is shown.

Ever since the days in Damascus, when the Lord sent Ananias into the street which is called Straight to inquire for one Saul of Tarsus, the people of the city have had an advantage over those of the country in being able to find, and direct others how to find, exact localities. In the cities streets are named and houses are numbered, and system and order prevail. In the country neither is done, and chaos rules.



THE MILE MARK.

A full circle for the full mile. X, ten; ten blocks; one mile.

The ten-block system of numbering houses along country roads, and the systematic plan of *naming* all of the roads of the country, which forms a necessary adjunct to it, is an attempt to place the country fully upon an equality with the city in these respects.

While the ten-block system, considered in its close meaning, refers only to the manner of numbering residences, etc., along the thoroughfares of the country, taken in connection with the other features which necessarily and naturally accompany it, the preparation for establishing it includes the arranging of the roads in suitable lengths for applying names, the selection of pleasing and appropriate names, the measuring and blocking off of the roads, numbering the country-house entrances, erecting guide boards, and the publishing of a country directory which will show the location of a country resident with as much exactness, and make it as easy to find any country residence, as it is at present to find a residence when knowing the street and number in the city.

The naming of country places, the advertising of the business specialty of the countryman follow in the same line of rural advancement, as well as the more material improvement of the roads themselves, and the free delivery of mail matter, telegrams, and a country express or package delivery in connection with the postal service.

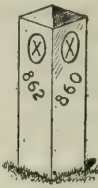
While the ten-block system supplies the one deficiency which at present makes this line of rural advancement impossible, the different steps will be considered in the order which would naturally be followed in establishing the complete plan.



THE HALF MILE MARK.

Half of the circle for the half mile. Half of X making a V. V, five; five blocks; one half mile.

The scheme was developed while working upon these lines in the interests of Contra Costa County somewhat more than two years ago. While at the outset the needs and requirements of Contra Costa were the particular situation to be met, it soon became evident that the plan



was needed fully as much and would be fully as useful in other country localities as at home, and the study has been from early in the work of its development to formulate a plan which would be generally useful in all country sections. The aim has been to develop a plan, systematic throughout, and to have a good reason for each step taken; to not only find a way to do a thing, but to find the best way to accomplish it. Hundreds

of papers have published accounts of it, and almost invariably to commend it. As the few attempts at criticism have not weakened it a particle, it appears to be safe to consider that its merits are strong enough to justify putting the plan into actual operation.

Contra Costa has adopted the plan officially, and the work of establishing it is now under way. It is frequently spoken of as the "Contra Costa plan."

*Listing the Roads.*—Before the houses along country roads can be numbered with any degree of satisfaction or usefulness, the situation must be given a shape very different from the one existing at present. The roads must be named, and previous to that being done, thought and study must be given to each stretch of road to be known by the same name.

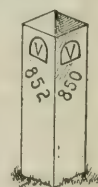
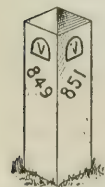


The first step, therefore, would be to arrange the roads into lengths, make a descriptive list of them, and for convenience of reference, number them in the list. This work is or should be a county

affair; should include the entire county, and the county seat is the natural center of the system.

The roads should be arranged in as long lengths as practicable. So long as a road runs in a general direction, or even if it deflects somewhat to either side, provided the angles are not too abrupt, the same name should be continued through towns, across streams, over ridges, and around mountains along its entire length.

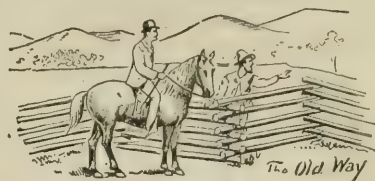
In order that system and order may govern throughout this plan, and that the course of the roads be not such that the lines will cross in all directions, they should all commence at the county seat or at the end nearest to it.



The roads should be listed, commencing with those departing from the county seat northerly, and work around in a circle toward the east, south, west, and back again to the north—the roads branching from these, and their branches follow.

*Selecting Names.*—In naming the roads the things to be avoided are perhaps even more important than the things to be done. The name of

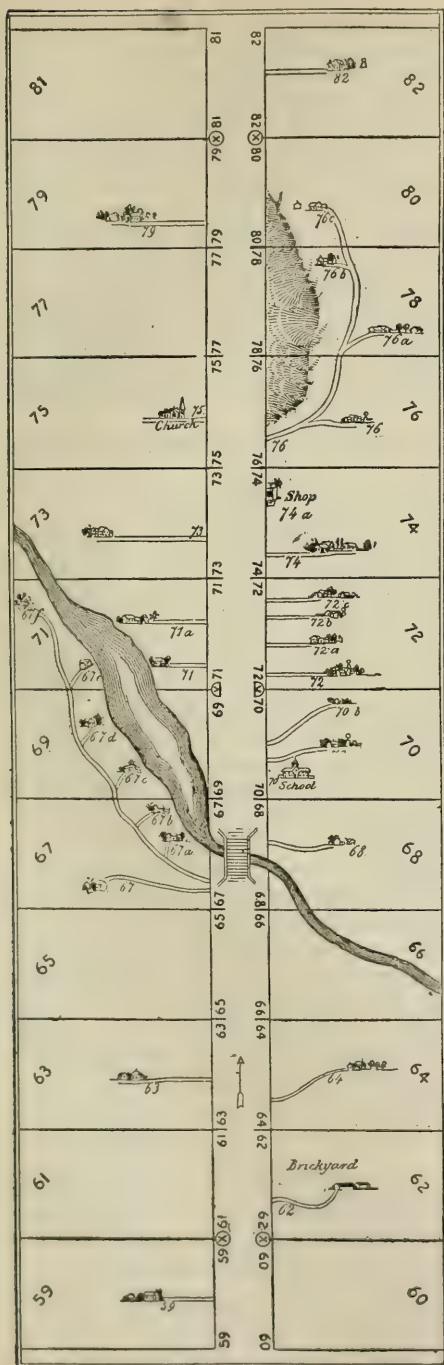
*The Road Marks on Square Posts.*—They can be made of wood, stone, or iron. They should be set with the corner of the post toward the road, with the two block numbers on the two faces of the post that can be seen from the roadway. See note on page 176.



*The Ten-Block System Illustrated.*—The blocks are imaginary ones, of 528 feet, or one tenth of a mile each, having frontage only. Two numbers are assigned to each block, the odd ones upon the left and the even ones upon the right. Ten blocks to the mile; twenty numbers to the mile. Any house having an entrance in a block has the number of the block. The number of all but the first house in a block is followed by a distinguishing letter—964, 964a, 964b, etc. The house itself, because of the nature of the country, may be placed at a considerable distance to one side of the entrance, but it is the location of the entrance itself that determines the number. (See block 76, 78, and 80.)

The ten-block system will be very useful in locating other things besides country house entrances. By use of the block numbers all such things as bridges, culverts, places on the roads needing repairing, picnic and camp-meeting grounds, points from which fine views can be obtained, or the particular point on a road where a certain event occurred, can all be located quickly, easily, intelligently, and with exactness.

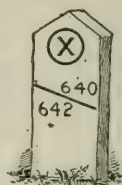
As all calculations of distance are made from the even numbers in defining the location of an object upon the road, unless the left hand side is definitely intended, the even numbers should be used.



THE TEN-BLOCK SYSTEM ILLUSTRATED.



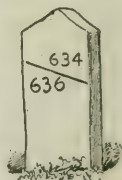
neither terminus is taken, for the reason that it would be appropriate only when traveling toward it. If both termini are taken it becomes more of a description than a name. The name of no living resident upon a road should be taken, for while it might be pleasing to the one whose name was so selected, it would hardly be so to any one else. The possessive case should be avoided; it is awkward to write, and is apt to be incorrectly done.



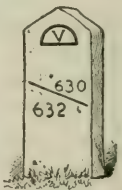
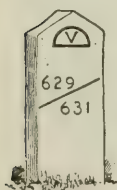
Names should be selected from among the landscape surroundings of the locality; from the historical associations or legends of the place; from its botanical or geological features. An average county is likely to have many more roads than can be given pleasing names from these classes. Other names can be selected from the names of statesmen, army and naval officers, battle fields, naval vessels, forest trees, etc.

The names should be short, easily spelled and pronounced. Two-word names are better than three or more.

In Contra Costa there are one hundred and thirty roads on the list. Some of the names particularly appropriate are Alpha Way, the first on the list. Contra Costa Highway, which extends from Martinez south, completely across the county. It is probably the most prominent road in the county, and the word highway is not used in any other road name. Alhambra Way runs through the valley of that name; Franklin Road through Franklin Cañon; Vista Rio, along the banks of and overlooking the river. Teal Local, Tule Road, Plover Connex, and Pacheco Exit are located near the river and tide lands. Camino Diablo is near the base of Mount Diablo. Solano Way extends in the direction of Solano County. Summer Road is a better road in summer than during the wet season.



Zig Zag Way speaks for itself. Concord Lateral extends out from the town of Concord like the lateral branch of a tree. Via Concordia is a branch of Concord Lateral, and is located near the town of Concord. Lime Ridge Crossing is expressive. Mountain Drive leads to the summit of Mount Diablo. Golden Gate Way extends from Walnut Creek to the county line toward Oakland, and ends in view of the Golden Gate. Walnut Way lies for a part of its length by the side of the stream of Walnut Creek, and has numerous native California walnut trees upon it. La Grange was the



*The Road Marks on Flat Posts.*—These posts are located at the dividing line between the blocks. The numbers indicate the block upon either side.

The ideal road will be fitted out with the road mark at each block division point, on both sides of the road. They will be on flat, iron posts, with the figures and marks cast on the faces of the posts the way the county guide boards of France are made. The raised figures and marks should also be painted a color different from the face of the post itself.

These flat posts could also be made of stone, with the marks chiseled upon them, or be made of wood, with the marks put on with paint.

The odd numbers upon the left, and the even ones on the right, opposite. Divide the even numbers by two, and point off one decimal, and you have the distance, in miles and tenths, from the commencement of the road to the completion of the block indicated by the number.

name of Lafayette's country home, and De Kalb accompanied him upon his expedition to America during revolutionary times. The roads bear-

ing these two names are located near the town of Lafayette. Camino Pablo commences at the town of San Pablo and extends up San Pablo Creek, through San Pablo Cañon, etc.

There appears to be a decided convenience, if not a necessity, to have certain kinds of roads distinguishable at once by their names. Therefore, three words—local, connex, and exit—have been used to definitely indicate three different classes of roads.

A local, as used in Contra Costa, is a road having no outlet—a neighborhood road. It will frequently be convenient for the traveler to know, before starting on a local, that he must return by the same way. A

connex is a short road having no branches, and useful principally in connecting other more prominent roads. An exit has no outlet except an exit by water. Silva Local, Sara Connex, and Granger Exit are samples of these names.

Unless work of this kind is governed by well-defined lines, it is apt to take some quite incongruous shapes. While one of the central counties of the State is far in advance of most other counties in the attention given to road matters, the names of some of

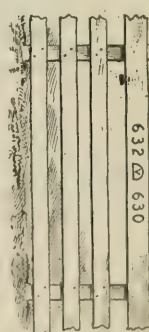
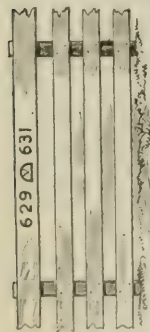
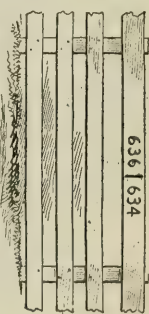
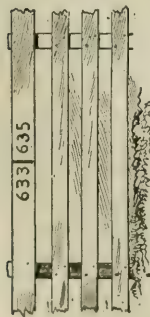
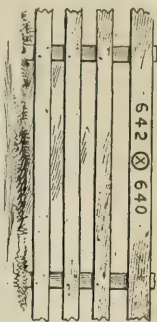
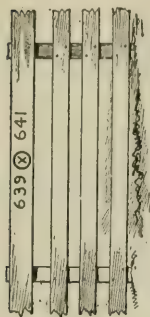
her roads as they stand upon the official register are open to criticism. Such names as the following are to be found, viz.: Hess and Battie

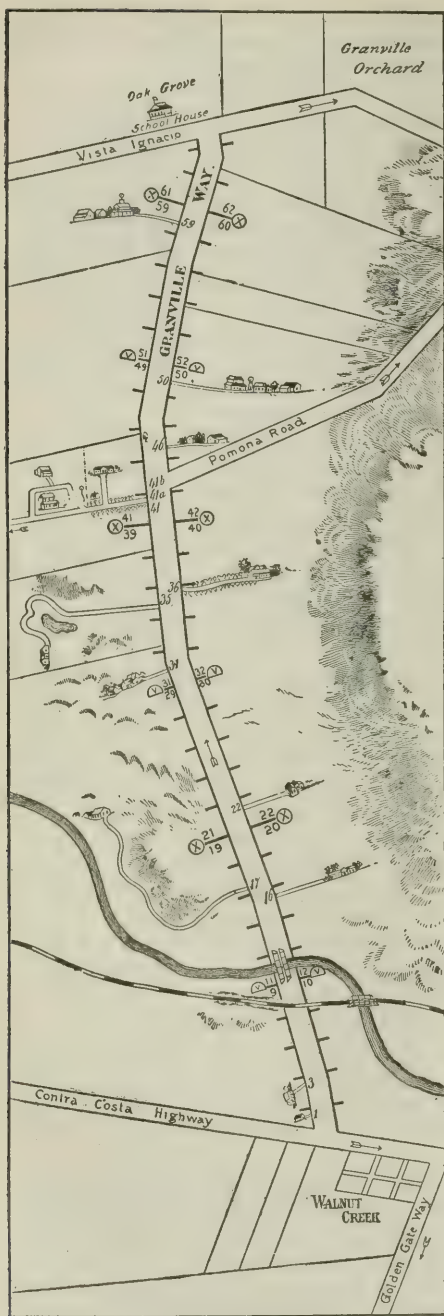
Road; possibly, like the Via Appia in Rome, named for the contractors who built it. Where such names as John Heinlen's Cart Road, T. B. Jamison's Cart Road, and Julius Martin's Public Cart Road (five words) come from it is difficult to conjecture. Why were they not called Ox-cart, or Dump-cart roads, and thus make the names artistic?

The following are more descriptions than names: Saratoga and Los Gatos Road, Alviso and San José Turnpike, and Mountain View and Alviso Road.

Bay View Schoolhouse Road is another long one. And here are some double-barrel ones: Prospect or Babb Road, Willow Extension or Settle

*Road Marks on Fences, etc.*—Where the fences are in sufficiently good condition, and are substantial, the road marks can be painted on galvanized sheet-iron plates, and be fastened to them. The better work of this kind is done the more satisfactory it will be, and posts of some kind are more desirable, because more permanent. See note on page 176.





GRANVILLE WAY.  
The first road blocked.

*Granville Way; the First Road Blocked.* All the roads of Contra Costa have been officially named, and the ten-block system of numbering country houses has been adopted.

While experimenting upon the field work and determining just what was to be done, and the best way of doing it, Granville Way was measured and blocked several times by different methods. Finally, the use of a steel tape 100 feet long, for measuring, and a surveyor's field-book, in which to make the records, were decided upon as being the most exact and satisfactory way in which the work could be done, and that method was adopted.

In the records filed with the County Clerk the exact position in or within the block of the entrances, bridges, culverts, and landmarks is given. For ordinary use they are not needed, and they are here omitted.

#### Road Directory of Granville Way.

No. 81 in official road list: From 213 Contra Costa Highway, near the town of Walnut Creek, east to No. 92 Vista Ignacio, in Ignacio Valley. Block numbers on the road, 66—i. e., 66 numbers, 33 blocks, 3.3 miles in length.

1. E. Dunn, Walnut Creek.
3. Two-story white house—vacant.
8. Summit of small hill, and crossing of San Ramon branch of the S. P. R. R.
12. Granville bridge over Walnut
16. Small bridge. [Creek.]
16. Mrs. Wm. Rice, about 4 m. distant. Mrs. X. R. Hill, Walnut Creek.
17. San Miguel Stock Farm, about .7 m. distant, owned by Irvin Ayres, San Francisco.
20. Summit of hill. Fine view back beyond the town of Walnut Creek.
22. Manuel Welch, Walnut Creek.
26. Summit of Spring Ridge; elevation, 250 ft. Fine view of Ignacio Valley and Mount Diablo.
29. Sulphur spring, about 75 ft. back from road.
31. A. G. Gurnett, Walnut Creek.
36. Small bridge.
35. Antonio Ginocchio, about .7 m. distant, Walnut Creek.
36. E. Randall. Samuel Randall,
36. Small bridge. [Walnut Creek.]
41. H. H. Bancroft, Walnut Creek.
- 41a. Aloha Farm, 4 m. distant. Aloha Farm Nursery. A. L. Bancroft. Geo. Reed, Supt. Bert H. Bancroft, Walnut Creek.
- 41b. Crofton, 1.4 m. distant. A. L. Bancroft, Walnut Creek.
42. Pomona Road begins.
42. Small bridge.
46. F. G. Tuttle, Walnut Creek.
50. Lot Moore, Walnut Creek.
50. Interior of Ignacio Valley. Fine view of Mount Diablo and surrounding country.
59. H. P. Penniman, Walnut Creek.
66. No. 92 Vista Ignacio. End of Granville Way.



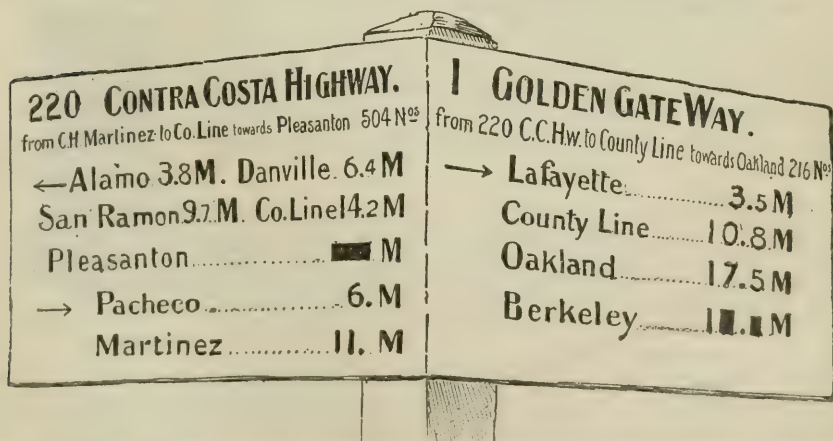
Road, and Lincoln Avenue or Mount Hamilton Road. These, however, may have been intended more for official convenience than for public use.

*Measuring and Blocking the Road.*—When the question of measuring was up for consideration, the first thing was an obstacle to be overcome. Where should the country road begin? Where is the dividing line between town and country? At the corporation limits? This country is new; towns grow; such a point would not be permanent; the whole structure, while it might be perfect at the outset, could not stand, but would crumble to dust. The difficulty is overcome in this way: By breaking through the frontier and going to some fixed central point and measuring from that, letting the town numbers govern within the town limits, and the country numbers commence when the limits of the town are reached; the first, and all other country numbers depending upon the distance from the starting point.

Still, keeping in mind that this is a county scheme, the county court-house, the center of county affairs, is the proper central point for the measurement to begin. Therefore, for all roads touching the county seat, the exact point where the measurement commences is the middle of the street directly in front of the main entrance to the court-house. From this point proceed by the nearest and most direct route to and out the road to be measured.

For all roads not touching the county seat, the measurement commences where the middle line of the road intersects the middle line of the road from which it departs. All roads, except locals and exits, end at the connecting road where the middle line of each form the junction.

With this system established, the town may grow into a city and take up miles of the country roads, and the remaining numbers along them will still be as applicable as they are at the commencement. Continuing the road name and road measurement directly through the



*A Contra Costa Guide Board.*—The first and most prominent line gives the name of the road. The figures show the number of the block in which the particular guide board is located, and enables the traveler to fix his location.

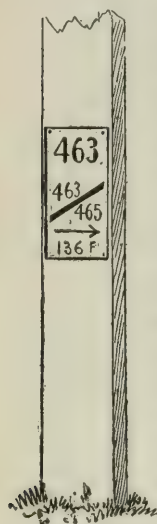
The second line shows the starting point and finish of the road, and length in block numbers. It is not intended to be legible without approaching quite near to the board.

The other lines give the information usually found upon guide boards, with the distances expressed in miles and decimals.

country towns, letting the town numbers govern within the town limits, and it completely overcomes this difficulty at these points.

Each mile is divided into ten equal parts or imaginary blocks, having frontage only—two frontages to each block—one upon each side of the road. The length of the blocks being one tenth of a mile, can also be expressed without fractions, by 528 feet, 176 yards, 32 rods, or 8 chains.

The measurement is continued uninterruptedly along the entire length of the road. Two numbers are assigned to each block, one to each frontage—the odd ones upon the left and the even ones upon the right.



On a telegraph pole.

*Numbering the Country Houses and Farm Entrances.*—All houses or farms having entrances upon a block bear the number of that block. Where there are more entrances than one upon the same block, which will not frequently occur, all but the first are given, in connection with the number, a distinguishing letter—982, 982a, 982b, etc. By this system, should there be an entrance every twenty feet on both sides of the road, over five hundred to the mile, a number with a letter would still be available for each one. On the other hand, if no house occurred for miles, or, if at any time afterward houses should be erected along the roads, a number would always be ready for them. Thus it will be seen the work is permanent; that new houses being built at any time upon a road will not interfere with the houses already numbered, and there is always a number ready for the new one. The only confusion that could possibly exist would be when the early houses in a block were located near the end of the block, and lettered accordingly, and the later buildings be located nearer the commencement of the block. The distinguishing letters would not then come in their regular order, and it is not absolutely necessary that they should so come; but, if revision of these letters should be considered advisable, it would be but for one block, and it would not in any way interfere with any of the others.



On a forest tree.

*Guide Boards, Road Marks, and House Numbers.*—As will be seen by a glance at the illustration of the guide board used in connection with this plan, while it contains all the information usually found on such aids to the stranger groping his way through the wilderness, it also contains some others.

The first and most prominent line contains the name of the road, in letters sufficiently large to be easily read some distance away. The number upon the left of the same line is not the number of the road in

*Road Marks on Trees and Telegraph Poles.*—Upon roads through mountainous and thinly settled parts of the country, and where distances are long and economy is necessary, iron plates, containing the road marks, can be attached to forest wayside trees, telegraph poles, and other available objects. The first line of figures gives the number of the block in which the number is posted. The following lines show just where the dividing line between this and the adjoining block comes; the direction being shown by the arrow, and the distance being given in feet.

the list of roads, but of the block within which the particular guide board is located. It will thus always be a landmark which will enable the stranger to establish his location.

The stranger, or even the local resident, knowing the name of a road, would naturally like to know something more about it. Where does the road begin, where does it end, and how long is it? The second line, in quite small letters, answers these inquiries. It is not intended to be legible from the middle of the road, but by approaching it the traveler can obtain the desired information. As the distances along the roads, under the ten-block system, are derived from the numbers—house, entrance, and block numbers all being the same—the length of the road is indicated upon the guide boards in this way, and not by expressing it in miles and fractions.

The information contained in the third and following lines is that which is ordinarily found upon country guide boards; the distances—mostly being to places not upon the same road as the one upon which the guide board is located—are given in miles, and as the whole system is a decimal one, the fractions are in tenths.

The guide boards themselves are made of galvanized iron, sufficiently thick to withstand a charge of shot from the new gun of the small boy or young hoodlum. The boards are bent at right angles, so as to be flat against two faces of the post, and the edges are turned back from the face of the board to give it rigidity. The ground of the board should be painted with luminous paint, which would enable the wording to be read at night. The posts should be of good dense 6x6 redwood, ten feet long, the part going into the ground coated with coal tar or asphaltum, and the part above the ground painted with two good coats of paint. The guide boards and numbers should be protected by ordinance of the Board of Supervisors, and by a feeling of pride and interested ownership being instilled into the hearts of children, both at home and at school, so that they would protect them the same as they would their own family or personal property of any other kind.

Along the roads—upon the fence, or other object, when suitable, and well enough preserved to warrant it—are fastened strips or sheets of galvanized boiler-iron, with marks to show the exact point of division between the blocks, with the block numbers upon either side of the marks. Three colors are uniformly used—one to indicate the mile points, a different one the half-mile points, and a third the block divisions at neither of these points. At the end of the full mile the full circle, inclosing a letter X (X, ten—ten blocks) is used. At the end of the half-mile a half circle is used; it incloses half of the X, making a V, which indicates half of the ten, or five—five blocks. Thus the story is told in several different ways, and if it is told truthfully, all should agree.

Along some roads very few objects will be found upon which it would be suitable to attach the iron plates containing the block numbers. Upon such roads trees and telegraph poles can be utilized, whether they are located exactly upon the line between two blocks or not. The number of the block in which the object is located can be given in full-size figures, and underneath smaller figures can be used to show the distance and direction to the dividing line. Of course, by going to the expense of planting posts or stone shafts especially for the purpose of supporting the numbers, they could be placed in their exact positions.



The distances being so readily and easily calculated from the block numbers, these marks answer every purpose of mile stones.

House or entrance numbers are required to be not less than three inches nor more than four inches in height, and they are recommended to be of the same material as other road marks—galvanized boiler-iron. It goes without saying that they should be neat and durable.

In England it is a universal custom to give names to the suburban and country places. It is a pleasing one, and should be encouraged. It would be appropriate to post the name of the place in connection with the house number; or the owner's name, or any business specialty in which he might be engaged, could be given. Thus the countryman would have a doorplate, or business advertisement, or a combination of the two at his entrance, which would increase his appreciation for and valuation of his home and surroundings.

*Country Directories.*—The roads being named and the houses numbered, a directory of the residents can be made with as much exactness and definiteness as is now possible of city people.

By limiting the words indicating town or city thoroughfares to the twelve following, viz.: alley, avenue, boulevard, court, park, place, plaza, promenade, row, square, street, and terrace—and using road, way, highway, local, connex, camino, via, drive, exit, etc., and all others for the country—a directory for an entire county, for both town and country residents, can be made under one alphabetical arrangement, and definite information can be given regarding all. For instance, if John Jones is given as 68 Contra Costa Highway, Martinez, it will be understood that he lives out on the Highway—the location being indicated by the number—and receives his mail at Martinez. If his brother, George Jones, is entered as 16 Ferry Street, Martinez, it will be known that that town is where he obtains his mail, and also that he lives in the town.

*The Ten-Block System.*—It will thus be seen that the ten-block system embodies the following features, viz.: Listing and naming the roads, in as long lengths as practicable; measuring and blocking them off into ten equal parts, or imaginary blocks, to each mile; assigning two numbers to each block, one to each frontage upon each side of the road. Any house having an entrance from a block has the number of its block.

*The Advantages of the System.*—The advantages of this system are numerous and great. Some of the more important ones are here recapitulated: The work is permanent, as much so as the roads themselves. Numbers are always ready for new houses which may be built upon a country road at any time, to any extent, without in any way disarranging the existing numbers. It is equally applicable whether the houses are twenty feet apart or twenty miles apart, and every number indicates distance. It is adapted to and useful in all kinds of country, whether flat or mountainous, and whether the roads are straight or crooked. Growing towns or new towns springing up along the line of a road do not, in the slightest degree, interfere with or disarrange the system. The measurement being continuous, and the numbers being dependent upon the distance from the starting point of the road, it matters not what part of the road is absorbed by the towns, the numbers remaining upon the country part of the road are as applicable and

useful as though the succession of the numbers was unbroken. For country distances the mile is the unit of measurement. The countryman thinks in miles. These country-house numbers indicate distances from which the miles can be calculated almost instantly. Divide the house number by two and point off one decimal, and the distance in miles and tenths is shown. In the case of odd numbers, add one to complete the block, divide by two and point off a decimal. Thus the numbers 981, and 982 opposite, both indicate 49.1 miles from the commencement of the road. With the aid of a key-map and key, taking up no more room in the pocket than a railway time-table, the distance from any house number to any other house number in a county, no matter where located, can be calculated in about one minute. Strangers can be directed and receive directions so that they can find the desired location without loss of time or asking a question.

A directory of country localities can be made which will be as full and definite as those at present published for city use; or addresses can be given in the poll list of voters, which would be useful, to some extent.

It will facilitate the official business between the county seat and the country. Road work can be more readily and accurately described. The fees of jurymen, witnesses, and county officials can be quickly calculated.

An official road register can be kept, which will direct to the book and page where all official actions taken by the Board of Supervisors pertaining to the named road can be found.

The producer of country commodities can the more readily advertise his products and find a purchaser; and the seller should be benefited thereby, while the would-be purchaser could the more easily find what he desires.

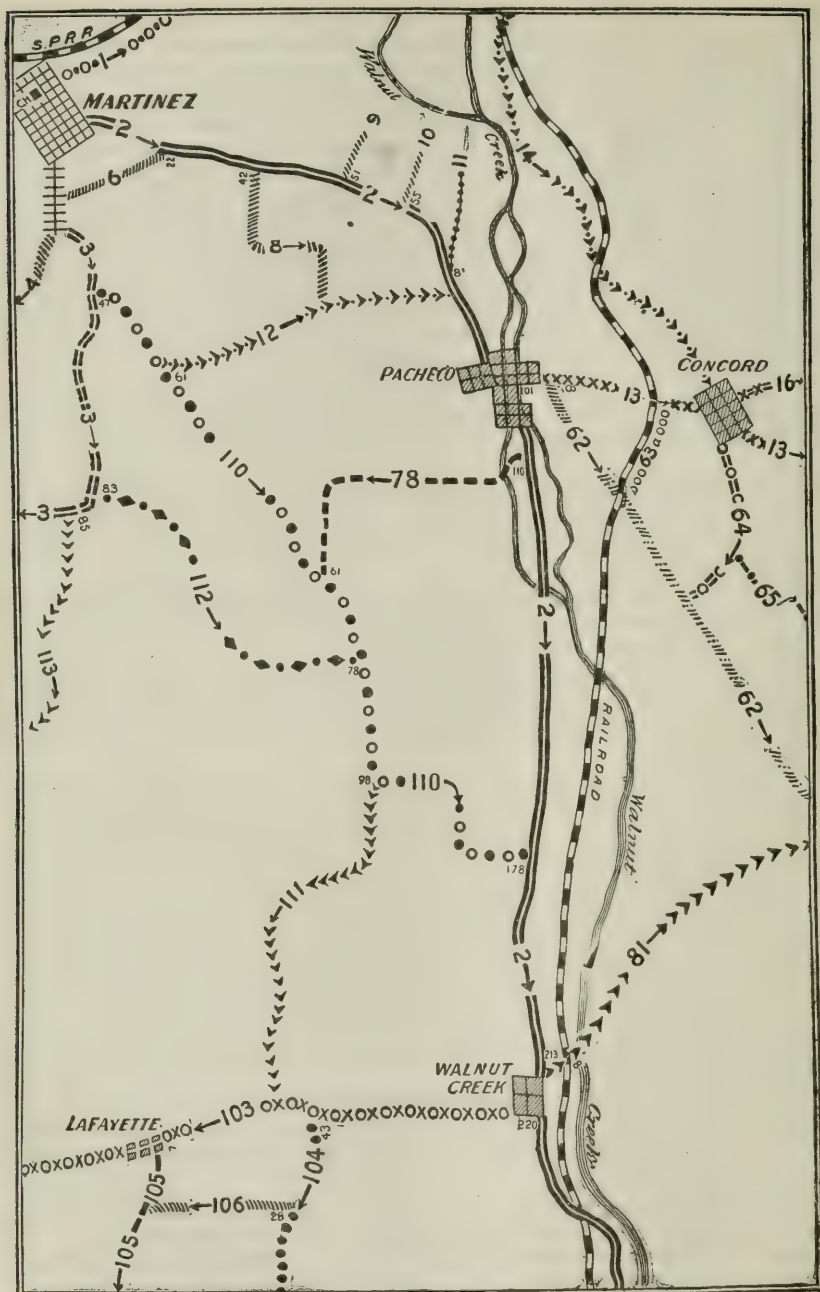
With the ten-block system in use it becomes feasible to establish mail delivery routes along the routes where they will accommodate the greatest number of people. Wayside mail boxes should be located along these roads, and be known by the name of road and number of block in which located; such as mail box 14, Ogontz Road, for instance. In these boxes could be deposited the mail, not only for the people living directly upon the roads, but also for those living within accessible distance upon either side. The boxes should have two compartments, one for the incoming mail and also one for the outgoing mail, both of which could be visited by the country postman as he passes along the roads sounding his bugle, thus giving notice to all within hearing that the postman was passing.

The influence upon the roads themselves will be important, for with people living upon named roads, and where the houses are numbered and the identity of the occupants known, the tendency will be to make a better appearance.

The intercourse between the town and country, as well as between the country people themselves, will be easier and more frequent.

As a result of all this the country will be a pleasanter place in which to live.

*The Present Situation in Contra Costa.*—A committee of citizens worked a year upon developing the system, shaping the system, and preparing an ordinance. It was upon the basis that the expense should



A TEN-BLOCK SYSTEM ROAD MAP  
Of the Central Portion of Contra Costa County.  
(See opposite page for key and explanation.)



## A TEN-BLOCK SYSTEM ROAD MAP.

The map on the page opposite shows the principal roads of the central part of Contra Costa County.

By means of the different characters used to represent the connecting roads, each road as named and mapped can be seen at a glance. The heavy figures in the line of the road give the number of the road in the official road list, while the small figures at right angles to the road show the block, or house or entrance numbers upon the road. Distances can be almost instantly calculated from the block numbers.

The following table gives the names and numbers of the roads shown on the map. All roads touching Martinez, the county seat, are measured from the court-house. Notice with what exactness the roads can be described:

Road List No.	Name.	Begins at	General Course.	Ends at	Block Nos. on Road.
1	Alpha Way				
2	Contra Costa Highway	Court House, Martinez	S. E.	Co. line tow'd Pleasanton	504
3	Alhambra Way	Court House, Martinez	W.	225 Franklin Road	316
4	Franklin Road	34 Alhambra Way	W.	Co. line tow'd W. Berkeley	428
5	Vista Rio	Court House, Martinez		Franklin Road, near Pinole	
6	Hillsdale Local	22 Contra Costa Highway	S. E.	Hillsdale	8
8	Morello Connex.	42 Contra Costa Highway		Vine Hill Way	
9	Teal Local	55 Contra Costa Highway			
10	Tule Road	Contra Costa Highway		Solano Way	
11	Pacheco Exit	81 Contra Costa Highway		Pacheco Landing	
12	Vine Hill Way	84 Contra Costa Highway		Locust Way	
13	Camino Diablo	101 Contra Costa Highway	S. E.		
14	Solano Way	Camino Diablo		Avon Station	
16	Willow Pass Road	38 Camino Diablo	E.		
62	Vista Ignacio	8 Camino Diablo	S.	Co. line toward Tracy	
63	Valley Center Local	78 Vista Ignacio	S. W.	Gove's	10
63a	Ogontz Road	30 Camino Diablo	S.	25 Vista Ignacio	20
64	Concord Lateral	36 Camino Diablo	S.	43 Vista Ignacio	36
65	Via Concordia	23 Concord Lateral	S. E.	44 Lime Ridge Crossing	32
66	Lime Ridge Crossing	68 Camino Diablo	S.	73 Vista Ignacio	60
78	Paso Nogal	110 Contra Costa Highway	S.	61 Locust Way	52
81	Granville Way	213 Contra Costa Highway	E.	92 Vista Ignacio	66
85	Kent Road	233 Contra Costa Highway	E.		
103	Golden Gate Way	220 C. C. H'wy at Wal. C'k.	W.	Co. line toward Oakland	216
104	Walnut Way	43 Golden Gate Way	S.	77 La Grange Road	104
105	La Grange Road	71 Golden Gate Way	S.		
106	Garden Connex.	9 La Grange Road	E.	28 Walnut Way	28
110	Locust Way	47 Alhambra Way	S. E.	178 Contra Costa Highway	130
111	Pleasant Hill Road	Locust Way		Golden Gate Way	
112	Sara Connex.	83 Alhambra Way	S. E.	78 Locust Way	64
113	Briones Road	Alhambra Way		Golden Gate Way	

## POINTS OF INTEREST ALONG SOME OF THE ROADS.

**2, CONTRA COSTA HIGHWAY.** 1, Court-house, Martinez. 14, Boundary of the town of Martinez. 22, Hillsdale Local. 42, Morello Connex begins. 50, Vine Hill school. 55, Teal Local. 60-62, Mosquito Bend. 74, Mount Diablo comes into view. 81, Pacheco Exit. 84, Vine Hill Way begins. 100, Town of Pacheco. 101, Camino Diablo begins. 110, Paso Nogal begins. —, Crofton Way begins, leading to Hookston Station, S. P. R. R. 178, Locust Way ends. 186, Summit of hill; fine view of Ignacio Valley and Mount Diablo. 195, Mrs. Felipa Welch. 213, Granville Way begins. 220, Town of Walnut Creek. 220, Golden Gate Way begins. 246, Starr King Road begins. 250, Crossing San Ramon Branch S. P. R. R. 275, Ramon Road begins. 293, Kent Road begins. 296, Town of Alamo. 306, Hemme Station, S. P. R. R. 347, Camino Tassajara begins. 350, Town of Danville. 356, Crossing San Ramon Branch S. P. R. R. 414, Harper Way begins. 414, Bridge over San Ramon Creek. 414, Town of San Ramon. 415, Fostoria Way begins. 428, Stanley Road begins. 504, County line; end of Contra Costa Highway. To Pleasanton, — miles.

**81, GRANVILLE WAY.** 1, No. 213 Contra Costa Highway, at the town of Walnut Creek. 8, Crossing San Ramon Branch S. P. R. R. 12, Granville Bridge over Walnut Creek. 20, Fine view back beyond the town of Walnut Creek. 28, Summit of Spring Ridge; fine view of Mount Diablo and Ignacio Valley. 44, Pomona Road begins. 50, Interior of Ignacio Valley; fine view of Mount Diablo and surrounding country. 66, No. 92 Vista Ignacio, near Oak Grove school; end of Granville Way.

**103, GOLDEN GATE WAY.** 1, No. 220 Contra Costa Highway. 1, Town of Walnut Creek. 43, Walnut Way begins. 49, Lafayette Cemetery. 50, Pleasant Hill Road ends. 70, Town of Lafayette. 71, La Grange Road begins. 91, Road not named (?). 110, Bridge. 110, Briones Road ends. 130, Summit of Charles Hill. 152, Crossing California and Nevada Railroad. 152, Camino Pablo crossing. 175, Laurel Connex begins. 177, — (Fish Ranch). 216, County line; summit of ridge; fine view of the Golden Gate, Farallon Islands, San Francisco, part of Oakland, etc. To Oakland court-house, — miles.

be paid out of the public treasury. It did not pass. Six months later it was presented again, upon the basis that the measuring and blocking-off of the roads be done at private expense, and when, or *as*, so done the county would, at public expense, erect and maintain suitable guide boards. With this modification the ordinance was passed, and the roads are now all named. Enough money has been pledged to establish the system over a few hundred miles of roads in the central part of the county, and work upon it has already been commenced.

A permanent committee of three citizens is charged with the duty of proposing names for new roads, seeing that the field work is properly done, etc. It is hoped that after the work done at private expense shall have been in actual use for a time, that the Board of Supervisors will order the remaining part of the county completed at public expense.

*Establishing the System.*—While the ten-block system is an interesting theory with which to tickle the imagination, there is but little doubt that it will be found even more pleasing and useful in active operation.

Although the originator of this scheme could not, at the outset, see any fatal defects in it, for the first six months or a year that it was before the public he did not have entire confidence that others might not consider it of no value. Now that it has passed under the scrutiny of so many writers and interested people without serious defects having been pointed out, he is becoming more confident, and feels that it is a plan that is safe to put into actual operation generally—the more extensively the better.

In order to establish it committee work is required, and a few good men should be found to undertake the service. It will require good, interested, persistent work. The committee must be brought into existence by the powers that be—the Board of Supervisors—or emanate from the people.

Unless the Supervisors would be willing to appoint such a committee at the outset, one public meeting, well planned in advance—to which all interested should be invited, where the subject would be discussed—should be sufficient. At such a meeting a committee could be elected, with powers to fill vacancies, or even to add to their numbers, and take all action necessary to give the movement shape, and present it to the Board of Supervisors for their action. A committee of five would be large enough, and then the most of the work would probably be done by two or three of their number.

This is a public work, and should be done at public expense; and the Board of Supervisors should be asked to order it so done, and for their entire county.

In Contra Costa the first meetings were held two and a half years ago, in Oak Grove school-house, in Ignacio Valley, at the base of Mount Diablo. Following the meetings in this school-house others were held in other school districts, and then two others were held at Martinez, the county seat. At the latter of these the whole matter was referred to a permanent committee of five, with power to act, and they now have something to show for the time spent upon it.

The work in the field of putting the system into actual operation has not been touched upon in this paper, but as sister counties arrive at that point they can count upon all the assistance that the pioneer work which is being done by Contra Costa will enable her to give.



## FUTURE PRODUCTION OF FRUIT.

MR. GORDON: I have no doubt that General Chipman's ideas as to wheat growing in the northern part of the State are well founded, but it seems to me his ideas as to fruit growing are not so well founded. The idea that the market for green fruit is unlimited is not sustained by the facts; and the idea that we should continue planting oranges in the way we have been for the last five years, seems to me a most fatal error. Take, for instance, our prune product, the principal product of this valley. Give me the portion of the Santa Clara Valley that is capable of producing a good prune, and I will guarantee to supply the entire consumption of the world in the next ten years. As a matter of fact, there are to-day more prune trees planted in the State of California than the product of which can possibly be consumed. The prunes that are to-day growing will produce—at an estimate of only one hundred pounds per tree, which certainly is a small one, if we can believe the reports—a considerable over 200,000,000 pounds in less than five years. Surely, is it not time to call a halt in this wild planting of prunes?

MR. BERWICK: I believe in the fruit business and I do not believe in the wheat business, but I believe that both sides of the question should be fully stated. We want a campaign of education in fruit growing and fruit eating as well. General Chipman spoke of a family eating 75 pounds per capita per annum. The Berwick family consumes 365 pounds per capita per annum, and I hope there will be a time coming when you will all be equally hearty with the Berwick family. Gentlemen, I believe in hygiene, and one great part of hygiene is good diet. I think that there is as much money spent to-day for patent medicines as there is for prunes, and I had rather spend the money for prunes than dose myself with patent medicine.

MR. MASLIN: I represent the State Board of Trade. I have had a number of intelligent inquiries from the East, and I am very glad to hear the discussion on that question. Now, I think it is like the old fable of looking at two sides of a shield. When I read the papers I find that in Tulare a man takes off from a tree 1,100 pounds of prunes, which is absolutely amazing; such statements do damage to California; then I go to another man who has an acre of prunes, as I know of some in my own county, who has planted prunes on the wrong soil, and in the course of four or five years the prune orchard is destroyed. As Mr. McWilliams says, every industry has a scale insect. You have got to get the right man on the right soil with the right climate to produce the right kind of fruit. There is a very large percentage of men who are not the right men, who are cultivating fruit, and it requires skill, courage, patience, learning, observation, and perseverance for them to become successful fruit raisers. Now, I believe that General Chipman's statement as to the value of the production of an acre of fruit is not very largely overdrawn, for in 1880 we shipped about 5,000,000 pounds of fruit, and last year we shipped 323,000,000 pounds of green deciduous fruits, excluding dried fruits, raisins, and nuts. Is it possible, Mr. President, that a community of intelligent people will go on for ten years and produce from 5,000,000 pounds of fruit, exclusive of domestic production, up to 323,000,000 pounds, if it is an unprofitable venture? There was a gentleman named A. G. Seale, who wrote from San José to London. He said he had worked in every valley in the State of California, and



he pronounced the fruit of California to be a humbug, fruit producers bankrupt, and the whole thing overdone; and he said a young man from Oxford and Eton, of good constitution, could scarcely obtain a living in California. I undertook to answer that letter, and took fifteen of the leading fruit counties of this State, and the assessment of the property, outside of the improvements, on the naked land as it was directly assessed, was \$70,000,000. In 1890, these identical fifteen counties, or the identical land, exclusive of town lots, was assessed at \$204,000,000. Why, Mr. President, if an Assessor should assess land two or three times higher—unless the valuation was based on the productive capacity of the land—he would be hung; and the owner only submits to it because the value is in the land. I have hundreds of inquiries from the East as to land, but the people there have an idea you ask too much for your land. I am sure \$300 or \$400 an acre for land is not too high, because I believe that expert fruit men do raise generally from \$150 to \$200 per acre upon the land. We are not telling a lie to the people of the United States when we do say that it is profitable.

Recess.

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## XVI.

### EVENING SESSION.

President COOPER in the chair.

### FLORA AND FOREST CULTURE.

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#### HERBACEOUS PERENNIALS.

By MRS. SARAH P. COOPER, of Santa Barbara.

The merits of annuals and bulbous plants in ornamental gardening having been the subject of successive papers at previous meetings, we would now like to invite your attention to the worth of herbaceous perennials. These, as the term indicates, have no woody fibers; the stems of most of them, after producing their flowers and ripening their seeds, die down to the ground; while the roots, retaining their vitality, send up shoots at their regular seasons of growth, and continue to do so for an indefinite number of years. Thus, so far as this class of flowering plants is concerned, the garden, when they are well established, is made for all time to come.

So great has been the demand for herbaceous perennials during the past years that to the lists of old favorites many desirable new ones have been added. New introductions and new hybrids have increased the number to such an extent, embracing in their reach a diversity of plants alike in color, so that different gardens in one neighborhood can be made to show a pleasing variety, thereby avoiding that sameness in decorative gardening so much objected to at the present time.

Beginning with blue, there is nothing finer than *Delphiniums*, *Salvia patens*, *Campanula carpatica*, *Commelyna cæleste*, and the blue Gentians.

In yellows: *Coreopsis lanceolata*, *Linum flavum*, *Alyssum saxatile*, *Hypericum elegans*, *Papaver nudicaule*, *Helianthus Japonicus*, and Wall-flowers.

In pink: *Pyrethrum Benedict*, *Hibiscus Moscheutos*, *Oenothera rosea*, Hollyhocks, pink Carnations, *Anemone Japonica*, and pink Stock.

The purples are: *Petunias*, *Pentstemon spectabilis*, *Salvia purpurea*, *Liatris spicata*, and *Heliotrope*.

In orange, the list is not so large. *Asclepias tuberosa*, *Papaver nudicaule*, and the *Leonotis leonurus* are very desirable.

Of whites and reds the catalogues are so full of varieties familiar to every one that there is no need to enumerate them here.

Much care is needed in the placing of these herbaceous perennials to have their full effect, especially the wild ones we are "accustomed to see among rocks and shrubs in woods and thickets." High-growing plants with showy colors should be placed against a background of dark green shrubbery; while the more delicate ones must be planted among open shrubs, that they may have protection from the too strong rays of the sun and from violent currents of wind. The moisture-loving ones should have their situation where they can be readily watered. Small plants, and there are many gems among them, should find safety in a rockery, and this should have a light shade from the afternoon sun. Some of the light, graceful acacias, the *Washington filifera*, when sufficiently grown, the beautiful *Parkinsonia aculeata*, afford the right kind of protection for these delicate things.

California is favorable, on account of its rich soil, to fine growths of sedges, grasses, bamboos, and such like things. And in a late number of "Garden and Forest" one of the writers in that most valuable periodical calls attention to the use that might be made of these plants in ornamental gardening.

The droids can be made to produce fine effects along with liliaceous plants, as *Tritomas*, *Cliniums*, *Pancratiums*, *Aspidistra lurida*, *Phormiums*, *Hemerocallis*, and some of the tall-growing irises.

There is a class of plants—the *Crassulas*—that are somewhat difficult to manage to good effect: *Echeverias*, *Cotyledons*, *Sedums*, *Sempervivums*, *Crassulas*, *Rochea falcata*. The large-growing ones can be used individually to good purpose, but as a rule they do not go well in groups. Clumps of *Echeveria metallica* make fine showing in the winter months, with their shrimp-colored stems and flowers. The smaller ones among rocks might do better treated as the cacti are.

The cacti—green, fleshy, thickened persistent, mostly leafless plants of peculiar aspect, as described by their authority, Dr. George Engelmann—are most interesting. There should be a corner in every garden for a collection of them. Their many and curious forms, the gorgeous coloring of their flowers, the night-blooming habit of some, many of them covered with tubercles, which, according to botanical authority, represent arrested buds, all conspire to make them, as a class, one most curiously interesting to study. Great interest is taken in them at the present time, and they bid fair, as a group, to become one of the fashionable plants among amateur gardeners. They are mentioned in this place, although they do not properly belong among herbaceous plants. They are described by some botanists as shrubs, and yet they do not seem like shrubs, but from their soft, succulent structure, are somewhat like herbaceous plants, and so I have put them in this paper.

The study of vegetable life in its varied forms has important interests for all, because as a study it is many-sided; to the merchant, for the marketable value of its products; to scientists, for the aid it brings him in understanding the general law of things; to the artist, that he may the better comprehend the relation of all beauty, and to the general gardener, for the pleasure and delight it brings, and for the freedom it gives from the burden of harassing cares and wearisome thoughts.

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## THE FUTURE OF FLORICULTURE IN CALIFORNIA.

### Some Personal Experiences, Etc.

By MRS. THEODORSIA B. SHEPARD, of Santa Barbara.

"I am certain that California before fifty years will be the great seed and bulb-growing country of the world. You have the exact conditions of climate necessary to grow seeds, and I would advise you to at once begin systematically."

These words, fraught with so much meaning, came to me ten years ago from the pen of the eminent horticulturist—Peter Henderson, of New York. Although I knew from limited experience that California soil and climate afforded the best conditions, I had not yet realized the possibilities of the growth of flower seeds and bulbs as an industry.

Like all flower lovers and collectors, I wished all the new and beautiful novelties offered; but novelties and choice things cost money, and my funds were limited. My first thoughts were to make the bulbs and seeds that ripened in my garden, and the surplus bulbs of my neighbors with whom I exchanged, the means of gratifying my taste for flowers; but it at last began to dawn upon me that there was a demand for much that could be supplied in California, and the words of Peter Henderson returned to me repeatedly. After two years of exchanging, my collection outgrew my ground. Adjoining our place was a two-acre lot, which I, after some coaxing, persuaded my husband to buy. It sloped gently southward from the high foothills to the sea. My husband had in *his* mind's eye an orchard on the lot, and purchased some choice trees, which were duly planted. A handsome residence and a fine lawn were to occupy the front, and I was given the privilege of growing whatever I chose on the ground in the meantime. But *I* saw a seed and bulb garden in *my* mind's eye on that two-acre lot. It is not necessary to observe that the trees vanished one by one. It was necessary that they should, to make room for lath-houses, green-houses, bulb and seed beds. Finally other ground was taken, and a variety of stock was grown and considerable space occupied, and to all appearances a business was established in a small way. I was not a business person. In all that goes to make a success in business I was decidedly amateurish. I attempted the difficult work of doing a retail and wholesale business. My collection was large and constantly increasing in variety and quantity. I got out my first catalogue of seeds, bulbs, and plants six years ago, and my first wholesale list five years since. Since then I have published three other catalogues and wholesale lists. I had difficulties to meet, chief of which were lack of capital, lack of experience, lack of knowledge of what to grow, and what prices to ask. I could not advertise, because I had no means with



which to do so, and did not know how if I had. Indeed, I do not know now. How to advertise has been one of the most difficult branches of my work. If indulgent friends interested in woman's work had not written me up from time to time, often alluding to me as the "pioneer seed grower of California," I fear my business would not for a long time have received the impetus essential to success. I found that any staple article I could raise in which there was no risk to the buyer I could readily dispose of, but of choice sorts in which there was risk, they were very shy, and informed me many times that they supplied themselves in Europe. Fortunately, I have never been easily discouraged. I knew the good qualities of California-grown bulbs and seeds, that none better could be produced, and felt positive that by perseverance in growing first-class seeds, and persistently offering them, I would at last *convince* the skeptical Eastern dealers that they *did want* California stock. I made many mistakes, and sometimes my heart sank within me. There was no one of whom I could ask advice, for none knew better than I. My husband and family and friends for a long time, though they threw no obstacle in my path, seriously objected to my working so hard, and going into business, and rather discouraged my ambitions, but when women are irrepressible, their friends generally come round in time, and so in my case. They finally ceased to dampen my enthusiasm with doubts of my ability to succeed, and became firm allies.

I am fully convinced that what "Peter the Great," in horticulture, expressed so long as ten years ago, is true. California will, in the very near future, be the great seed and bulb-producing country of the world, and be the great nursery of the world as well. Great flower farms for perfume will dot the hills and valleys; immense nurseries for growing choice and rare palms trees, shrubs and bulbs for export; wonderful plantations of the stately giant bamboo for manufacturing purposes—all these and many more. No State has so great a future; no State can supply so great a demand, as this our California, with its wonderful possibilities, truly the Golden State. All the gold, and more than has ever been taken from her bosom, will be poured into her lap again, in exchange for the valuable products that grow in her rich soil. Floriculture, once an infant, has long outgrown its swaddling clothes. I well remember hearing men say, "Oh, flowers; there is no money in them. They are all very well in their place, but give me potatoes, beets, and cabbages; they are worth something, they are good to eat." Now, no one denies the commercial value of flowers. They are staple articles. Once they graced our grandmother's gardens, or were the privilege of the wealthy few, or were occasionally used here and there for a wedding or a funeral; now no house is complete without its garden, no entertainment considered a success unless flowers are used as decorations. The æsthetic taste of the people demands beauty. Their homes, their weddings, funerals, entertainments, their persons, must be adorned with flowers.

Flower culture is a work for which women are preëminently fitted. There is scarcely a branch in which an intelligent, energetic woman with any love for the work could not succeed, if she has self-reliance and determination. The varieties of stock that can be grown and are in demand are innumerable. There are staple articles always called for. Novelties are eagerly sought, and often small fortunes made on one new bulb or plant. A novelty in plants is often like a new song which strikes

the right chord and every one sings it; it strikes the popular taste, and every one must have it. Novelties are either sprouts or from seed. If from seed they are the result of natural or artificial fertilization.

Among the many attractions of my garden two years ago was a bed of very beautiful and choice petunias. Not the little magenta-colored plebeians of our childhood, but very aristocratic petunias with high-sounding names, such as *Petunia hybrida grandiflora*; Prince and Princess of Wurtemberg, etc. Every plant in the bed had been raised from the choicest seeds to be had in the country, but the most beautiful of all were some single and double fringed ones raised from seeds of my own hybridizing on a lovely foreign strain. I spent many hours cross-fertilizing the flowers for seed. One morning, when thus employed, a flower-loving friend, Mrs. Gould, who also had some very fine petunias, paid the flowers a visit. She begged me to teach her how to fertilize a flower, and after I had shown her the simple process, she suggested that we should exchange flowers for cross-fertilizing and hybridizing. We frequently met among the petunias during the summer, discussed their possibilities, and planned for their improvement. One day I proposed to Mrs. Gould that as she was such a lover of this valuable bedding plant she make a specialty of it, and see what she could do with it by intelligent work. Her thoughtful "I believe I will" meant a good deal, for the following season she brought me some specimen petunias, the result of her first efforts. There were fifteen or twenty flowers, no two alike, all perfect in form and color and giants in size. Their pictures were taken and sent East; letters of commendation, descriptive and introductory, followed. After they reached New York they were christened "The Giants of California," and the next season their pictures, life size and life-like colors, ornamented the outside cover of a catalogue of one of the largest seed merchants in the country. Now our little Ventura specialist (of whom we are all very proud) has orders for all she can grow. She is still at work hybridizing, and operates skillfully and with unabated enthusiasm. She knows the pedigree of every new petunia that blossoms in her garden, and works for a purpose with ever flower she crosses.

Mrs. Gould's success shows what any woman, with enthusiasm, intelligence, patience, and determination can accomplish. "The elements of success are in the individual," and as Emerson says, "Nature is thoroughly meditate. It is made to serve. It offers all its kingdom to man as the raw material, which he may mold into what is useful. Man is never weary of working it up. He forges the subtle air into wise and melodious words, and gives them wing as angels of persuasion and command. More and more with every thought does his kingdom stretch over things, until the world becomes at last only a realized will, the double of the man."

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### A WOMAN'S ORCHARD.

By MRS. GEORGIE MCBRIDE, of San José.

Some one has said that "woman is the greatest discovery of the age." The next greatest is the discovery of the opportunities afforded her in all the walks of life—to become independent; and in no quarter of the globe can she grasp them so thoroughly and successfully as in our own beautiful



State; nor can she find any occupation more remunerative than horticulture. It has been one of the latest fields of labor opened to women, and too little is known by them of its possibilities. In this utilitarian age, when most women are striving to be financially independent, there is no avenue thereto replete with such pecuniary results as horticulture; and, as all trades and commerce depend on the products of the soil for their foundation, the incentive to produce good work is great, as the returns are sure and profitable. She must not scorn to lay hold with her hands. In the orchard, as in other pursuits, there is no royal road to wealth—toil is the price of success.

She can engage in this work without loss of delicacy, grace, or refinement; it gives her an insight into business, and strengthens mind as well as body. If, as is often the case, she has children dependent on her for support, she can have their assistance in her work, and by precept and example, elevate their thoughts and ambitions to a sphere where they will not be subjected to the strong tide of temptation which surrounds them in the cities, and often bears them away beneath the flood.

Some twelve years ago a lady from the East came to this beautiful valley, seeking to make a home for herself and four little boys among its hospitable people. The fruit industry was beginning to attract attention, and she invested in fifteen acres of stubble land in "The Willows," and proceeded to put out an orchard. She was undecided what varieties to plant, but was assured that *everything* paid; that egg plums were bringing 6 cents per pound; that there could never be enough black cherries to supply the market; that this was one of the few favored regions that grew the apricot; that some growers had made \$500 per acre on peaches, and so on through the whole list of fruits. By the time her egg plums were in bearing they were a drug in the market, and were replaced with French prunes. Apricots were mostly of the Moorpark varieties, and, as all know, are shy bearers, but they have yielded as fresh fruit \$400 per acre. The peaches were badly affected with curled leaf, and have also been removed; some good varieties have yielded \$5 per tree. The black cherries have made a fine growth, but have never borne full crops, except where near some white varieties; they have yielded \$300 per acre. Pears and apples were also planted, but owing to ravages of scale and codlin moth, have long since been replaced by French prunes, and at this time the orchard is composed almost entirely of that variety of fruit. She thought when she had paid for land and trees and planted the orchard, that most of the labor and expense were over until the harvest could be expected, but she found the work was just begun.

The soil proved to be excellent, and the trees grew satisfactorily, but she found that young trees, like children, need both watchful care and pruning; and while her boys were at school she toiled unceasingly for the rich returns she was assured were just within her grasp. Enthusiastic friends told marvelous tales of some one else's profits on fruit; she was assured that within three years, at most, she would have more money than she would know what to do with; could rest her weary form in a patent rocker, and have a capable heathen in the kitchen. So she hoed, and dug, and pruned, and lived on hope—which proved a good calculator, but a poor mathematician, as the aforesaid luxuries are still in prospective.

Like others in the business, she made many mistakes; but whenever



she threw to the breeze her signals of ignorant distress kind neighbors and friends came to her relief, and with advice and assistance put her on the right track again. She prospered so well that she was encouraged to add twenty additional acres to her original purchase. Having raised her own help, she was independent of the unskilled Chinaman, and had willing assistance from her four boys, the oldest of whom was not fifteen years of age.

Insect pests were doing their greatest damage about this time, and the first year of planting the destructive *Diabrotica* was only prevented from destroying her trees by the strictest vigilance, one neighbor losing one thousand six hundred by their ravages. She was well nigh discouraged, but a sympathetic friend bade her hope on, and not give up, as there was "a bug in every business."

While she found the work in the orchard laborious, it was also healthful and fascinating, and if she did have to rise with the lark, she could go to bed with the sun. A meeting with a neighbor always brought up a discussion on fruit, its probable yields and results were figured up, and everybody got rich—on paper.

The fourth year her orchard began to yield some fruit, and then her troubles began. Not being prepared to dry her own products she was forced to sell them green. A buyer would make an offer for fruit, good for that day only, as he had within a few tons of all he wanted, and the market was falling. If she suggested that the crop was light and should command a better price, he would say that the shortage was only in her immediate neighborhood, that in other portions of the county and State the crop was unusually heavy, the trees were literally breaking down, and so on. On the unsophisticated this information would be likely to produce a panic, and a sale was often made upon such representations. If she had backbone enough to hold out for a higher figure, he would probably return in a few days with the statement that he had received later advices, a telegram from Persia, may be, and from the Shah, of course, enabling him to offer a slight advance on former prices, but had *now* reached the limit; that he would not think of giving such figures, only that he knew where he could dispose of a few tons at prices that would justify it.

A few such experiences as this were calculated to break a poor woman all up, so she decided to make the necessary preparations and dry her own fruit. And every grower knows what this means. It is the end of panics and uncertain prices, for dried fruit is as good as money in bank.

And now she made a discovery: She had been selling her green prunes on a basis of three pounds for one. She found by experience that it did not take more than two and one half pounds for one, and some exceptional years not so much. She was also told that she could not have them *too* dry. She found that when all the moisture was extracted, they went in a lower grade, and she not only lost in weight, but in size also. Now she finishes the curing by keeping the trays covered, and gets all there is in them.

Experience has taught her that to dry her fruit for market is the most profitable way of disposing of it. While 3 cents per pound is a big price for green prunes, it is not more than 8 cents for the dried, and when they do sell for \$60 per ton green, they are always easily disposed of at 10 cents per pound or more dried, as they are as much a staple as wheat or wool.

Selling to the canners has proved unsatisfactory. They, of course, want only the best fruit, but have been known to reject that on some trivial pretext, if they found they had contracted for more than they were likely to dispose of.

Shipping green fruit to the San Francisco market she found to be still worse, as no matter how fine the fruit she always got the lowest quotations.

She is entirely satisfied with her venture in the fruit business, and does not know where in the State she could better her situation for that pursuit, unless she should try San Diego County, where she has heard there are millions of acres of orange land, of unheard-of fertility, awaiting an investor, and where they raise oranges on both root and branch. She is only one of many ladies engaged in this work who take an interest in it and do it well. A widow in this business is not known by her weeds.

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### HOME ADORNMENTS.

By MRS. MAGGIE DOWNING BRAINARD, of San José.

This subject, in the ordinary sense of the term, has been crocheted, painted, and bric-a-bracked threadbare. In the popular gewgaws in which a giddy fashion has enveloped it, its genuine beauty and true value are lost under the idea that it is found only in the depths of wall pockets and under the folds of slumber rugs.

Home adornment begins with and lies principally in its living, breathing occupants. Its most valued jewels are the souls of these inmates, and their gilded settings or spotless wreaths of fresco work emanate from the love and warmth of sincerity found in generous hearts. Man is susceptible to an absolute change in his nature by his daily surroundings. He is as much a creature of habit as of reason. Home influences, therefore, go more to make up his character than any other direct impression.

Every child is born with some peculiar characteristic, and home adornment has just as much to do with the stifling or the expanding of that bud of genius as an academic education.

For instance, if the strongest proclivities of that nature lead to conquest, nothing will help the young mind to study out its problems better than the "Battle Scene," traced by mother's fingers on canvas in paint or tapestry, and framed on the pure white wall. A group of stuffed birds upon the mantel, and near by, in all good faith, a cunning squirrel eating a nut, a case of butterflies and another of bugs, sharpens ornithology and its kindred science in the mind that bends in that direction. Delicate wild flowers, pressed and tastefully combined with shading grasses, the young botanist views with daily delights. The chemist is struck with curious interest as he puzzles over a bunch of snowy phantom leaves and seed pods, deftly wound about a black velvet cross, and racks his young brain to know the secret by which the dead matter is carried off and the fairy lace work left intact. The poet and the novelist form ideals of grace and luxury from soft cushions and filmy scarfs that adorn each settee, chair, or picture; and the genius of invention, set to work by a close inspection of hand-made bric-a-brac, develops at once into a baby marvel of the mechanical world.

Each object thus taken, especially from the kingdom of nature, as home ornament, implants a lesson in the seed garden of the heart, that blooms and bears fruit upon the pages of history, biography, and romance in every tongue and under every clime.

Growing minds are not the only ones thus impressed, neither are the intellectual parts of the individual all that bear the signet. The passions, as well as the spirits, come in for a goodly share. Tell one this ordinarily, and he will deny it. He has never become aware of the fact, that is all. Pick for yourself, from the world, a specimen whose home adornments, in every shape, form, or fashion, are lacking. The curtains at the window hang in stiff folds; the great, bare walls loom up like phantom shadows, and the stiff-backed chairs, devoid of little ribbons, laces, or soft, clinging zephyrs, seem at "drawn daggers" with you, as well as the whole community. Before you know it, no matter how congenial you may be by nature, you return the madam's bow as cold and formal as her own. You seat yourself with an uneasy feeling, and a queer, dissatisfied air creeps over you. The fire burns, but the hearth looks cold; the lamp shines keen, cutting, sharp. Presently the old grandmother hobbles in, querulous and crotchety. She seats herself with the same uncomfortable air pervading the house, and as the children gather in a rude, noisy group about her, and she pulls her knitting from her pocket, one little one eagerly says, "Now, gran'ma, tell us somethin' 'bout your neighbors." The secret is divulged. *Gossip holds sway in that household*, and home adornments, despised as useless tawdry, have no power to checkmate the devil's greatest emissary. Man is not, by nature, depraved. But his mind, soul, or whatever you may call the infinite part of him, is so organized or formed as to need, whether he sleeps or wakes, constant feeding; and whatever is at hand the most convenient for the flame is consumed—if not fair, it must be foul—the body is fed by the flame. If the fire feeds upon the tainted it must necessarily become a putrid mass, and the earlier it becomes so the denser the corruption.

Home adornments, if judiciously selected or made, bear, on balmy wings of purest whiteness, peace and rest to mind and body. A great historian once said the way he rested from his arduous work was to lie down and read the "trashiest" novel he could find, the idea conveyed being a diving into exactly the opposite field. So the horticulturist, whose fields are laden with luscious fruits of purple and gold, and where fairies hold revels in the perfumed flower-beds about his doors, should adorn his home with scenery, mechanisms, symbols, and beauties found in busy cities, upon the high seas, or in the mines of the earth. In these he will find a wondrous pleasure, as he turns for a moment from the outward scene. The citizen, however, denied God's fairest boons—in green grass and blushing flowers, in mirrored lakes and balmy skies, in sun-kissed mountain vineyards and laden, golden-crowned orchards—must paint his walls with these, and deck his mantels and bric-a-brac with their fairest imitations. To him the inward contrast, as he leaves his counting-room and seeks his home, will be an earthly paradise, 'mid living angels flitting near.

Man's first home was adorned with every natural beauty that could be devised by the Godhead himself. The original idea of a certain divine, that "Adam was made of mud and set against the fence by the roadside to dry," has long since exploded, even in the originator's mind.



Bearing the impress of the Deity in his being, one of the most beautiful thoughts of all comes to our mind of what was contained in that open book, laid in his hands to read, when man became a living, breathing creature. *Every lesson was written in adornments—home adornments.* Life and Death were painted there; the dew sweats of sorrow and the rippling laughter of joy bathed flower petals in shadows, or tipped them with sunshine and waited in innocent ignorance to follow the future fugitive into exile. The warbling birds and sunny skies, the sparkling waters and balmy air, breathed still of heaven in the presence of the Maker, and gave a lingering tenderness and pride to the finishing touches of His creations. The wondrous power given to leaf and bud for development directly under the human eye, and yet, although the change was radical, no perception could detect it.

Wrapped in the mystic workings of the leaf, veins rolling over veins and tissues lacing and interlacing, breathing, growing, living, dying, are the mysterious, unfathomed workings of the *human* heart. Science cannot unravel the secret, neither can the man himself solve the puzzle, although his breast holds the problem, and the end is with him—life or eternal death.

The tree, the bearing tree, with its fruits and its flowers, and its silent growth of leaf, bud, and limb, is a link between the long, unseen corridors of the soul of man and the merciful face of his maker; through it was death, through it redemption—the only pleasure and greatest beauty left him from his Paradise Lost, and the most *grateful*, as well as useful and beautiful of home adornments.

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#### DISCUSSION OF PAPERS.

MRS. MATTIE S. JONES, of Yuba City: I am the fortunate possessor of a small orchard in Sutter County, but I am not at present carrying it on myself; however, for a year or so I had some experience in the fruit business, and that experience fully demonstrated to me that horticulture may successfully be carried on as woman's work; I see nothing to interfere with her making a success in that branch of the business, provided, of course, she is in love with the business and takes it up as a business. I did not begin at the bottom, but through the unfortunate circumstance of my husband's death, I had, as you might say, to jump right into the business and take it up. I knew but very little about it, and found in taking up the business that I not only had to learn how to handle the fruit, how to pick it, how to market it, how to cultivate the land, and all those things, but the orchard was very badly infested with scale, and I had to study up that portion of the business, and found it a very lively business—the bugs were very lively, and I had to be very lively to get ahead of them, or else I wouldn't have had any orchard. But I feel that I have made a success of horticulture. I gave it up principally because I had no family, and I didn't care to be alone on the orchard, and my health failing, I thought it was best to do so; but I have not lost my interest in it, and probably at some time I may take it up again.

F. A. KIMBALL: As an evidence that the destruction of the forests has a very great effect on drying up a stream, I would like to say that in New Hampshire, where I was raised, when I was a boy I remember

many of the small streams were perennial streams and never ran dry, and on the borders of which I could count some forty farms that had at one time or another been entered for a premium at the State and county fairs in competition with the best farms of the State, and I can count forty of those farms now on which there is not a single house—the forests have been removed, the brooks have run dry. I believe that the preservation of our forests, or, when cut down, the replacing or planting of new trees, is a matter of great importance to the State, and should be insisted upon by such laws as govern in such cases.

## XVII.

## TRANSACTIONS OF THE FOURTH DAY.

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THURSDAY, November 19, 1892.

The convention was called to order at 9 o'clock A. M.  
President COOPER in the chair.

## PRUNING THE APPLE AND THE PEAR.

By A. CADWELL, of Stony Point.

Through the solicitation of Dr. White, State Horticultural Commissioner for the Sonoma District, I will give you my experience in pruning trees, especially the apple and pear. In my locality we raise as fine apples, pears, and cherries as they do in any other part of the State, by pruning as little as possible; but this little must be done right. In the beginning I did some terrible work, for many years using my own and others' experience, and still did not attain the best results. So I commenced to try a different plan, working close up to nature's work. The first lesson I had was with the Roxbury Russet tree. This tree bore very fine apples for many years, but finally stopped bearing and growing, so I headed it back and got no wood nor fruit. The next year I cut the old stumps again, but with no better results. The next year I cut all the fruit spurs off, and that year I had a beautiful growth of wood. This pleased me, and the next year I had a fine lot of apples on the young wood, and a fine growth. After that I cut off all old spurs, leaving only one or two buds to bear fruit, and allowed the tree to make all the wood it could. This was a success. I then concluded that I was pruning my other varieties to excess, especially the Yellow Newtown Pippin trees. I practiced the same plan in this case—allowed the trees to grow and pruned off the spurs. The old wounds healed over and the trees became very vigorous. It acted like magic on my Spitzenbergs, Bellflowers, and Greenings. I also had Bartlett pears that had been getting smaller for several years, and I could not see the cause. I had pruned to get wood, but I neither got wood nor fruit. I finally went for the spurs, and the next year the growth would surprise any one. So after that I did not cut the tops, and those same trees are thirty feet high now. You may ask, What do you do with the fruit that grows on the tops of those trees? Why, I let it fall and pull it out; they have abundant crops besides—a striking contrast to the little dwarfs they used to be.

Twelve years ago I set out many young trees in the place of old trees, and resolved to let nature take its course and not head back for ten years. Those same trees have been pruned only where branches were too low. In this way I find that at first the tops will go up twenty or thirty feet high, and in due time they will come down with fruit, so that you can pick the fruit from the ground. Then there will be a young growth start



up from those branches bent down, and make a beautiful top right over your head, besides bearing all the time. Then cut those branches off from six to eight feet from the body of the tree, and you have a foundation superior to trees huddled to death when young; then there will be few places to heal over compared with the present system; and when I do cut a limb from the body of the tree, I cut as close as possible and cover with wax, or something that will stay. Young trees will not bear until they have attained age enough to mature their fruit spurs, and nature will do better than any man in that direction.

I also found that in cutting off the low branches you must be cautious and cut where there is a strong branch running up, or otherwise the whole limb withers and decays. It will be there the next year the same as you left it, and finally will have to be taken off close to the body.

It is better to let the top of your trees grow out of your reach, and never pick the fruit thereon, than to head it too much. Do not cut off the ends of new wood on old trees. Instead, cut the oldest wood; cut fruit spurs mostly.

The peach tree should be left alone until it bears the first crop, or even the second crop; then, as the tree gets older you will have to cut all old wood out and enough of the new to make a strong new growth every year, or you will not get the best of peaches. Please bear in mind that our locality is in the fog belt, and that my observations will not apply to every locality.

Now, I will say this: that it is better in my locality to set out young trees and head them to your waist, and afterwards for ten years never put a knife into the tops, only cutting such branches as are in the way of your horses. I can convince any man of this theory that will take the pains to investigate.

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#### DISCUSSION ON PRUNING.

PROFESSOR HUMMANN: It seems to me that that essay contradicts itself so much that nobody else need either contradict any of the statements or pass any criticism upon it.

MR. MCWILLIAMS: I take great exceptions to that article that has been read. In the first place, I have pears that are growing twenty feet high. He says let them fall. They will burst wide open; you cannot do anything with pears that fall thirty feet; you certainly would get but very little fruit that is fit for shipping, or for canning, in that way. Another thing I take exception to: He says trim your trees up so you can plow close to the trees. Now, I have trimmed my trees in every conceivable way I have been told, and finally I have come to the conclusion, with the experience of some thirty years, that I have a mind of my own, and shall trim them to suit myself. Now, the great expense with our peaches is in thinning, and when I have my trees so that I have to climb up on a ladder, I find it is a great deal of trouble to go around and thin them with a ladder. I first thought I would let them run up, but they run and run until they got entirely too high and at the expense of the low branches. This year I have got my trees trimmed with not a limb higher than six inches to a foot, so that it is a perfect hedge, you may say. It is true I can't plow, but at the same time the expense that is saved in dispensing with the ladder and all the work in attending to

the trees overcomes the labor of hoeing off the weeds that grow under the shade of the trees. I have my orchard right low down; it shades the trunk of the tree, and saves expense in that way, and the trees are just as thrifty, and I have had just as fine peaches as ever I had in my life. The limb bends down to the ground, and I have quit trimming them up for the purpose of saving trouble in plowing close to the trees, and I find it is a success.

MR. JOHNSTON: As the author of the essay is not here to explain his paper, I will endeavor to do something for him. You who have been careful in listening to the reading, will note that he starts in by saying that he has had no experience; and undertaking to learn, he made mistakes, and he also says that his theory would not apply to all localities; he is speaking for mountainous, rough country. He acknowledges to have ruined some trees by his experiments, and that before he got any fruit he got his trees thirty feet high. Then he tells you how to commence and raise trees; in that I think he is pretty nearly correct. So far as the Bartlett pear is concerned, he says do very little trimming for several years, but that after the tree gets a certain age until the fruit spurs come out and produce fruit, let the tree grow up, and as it bears fruit it will spread out, if you remember, so he could pick the pears from the ground, and not be thirty to fifty feet high. His thirty-foot and fifty-foot high trees were those that he had been experimenting upon, and he tells us not to do the same as he did when he commenced, but to do as he is doing now: let your trees grow while they are young, and when they begin to bear they will spread out and make large trees. I think the argument is a good one, especially in mountainous countries, where they spread out but don't grow so tall. Just as long as you keep cutting the top off the tree it will grow up, and the more you cut the more it will grow. I am very much in favor of his theory, so far as the Bartlett pear is concerned; I am not so much in favor of it in reference to the peach, for I differ very much with him in that regard; but as to the idea that it contradicts itself, I differ with the Professor, for he tells what he did do, and then what he ought to do, or what he is doing now; that he is raising trees which spread out in wide branches.

MR. BERWICK: I begin cutting my trees, pruning off the wood for several years. I don't have my trees thirty feet high and lopping over, which means a long, thin branch with fruit at the end. I want to have it where I can pick it by hand if possible without mounting a thirty-foot ladder, and I have successfully followed that plan in raising a few trees only.

COLONEL HERSEY: In planting an orchard, I cut the trees down to sixteen or eighteen inches, and all the shoots come out from the sides; if there are two that come out together, and that look as if they would split, I cut them away and let one come out lower down, so that when the tree grows it is not going to split apart. I have been troubled with some of the trees planted on my place before I came there, and I have been obliged to put iron bolts through them in order to prevent them splitting down when they are loaded with fruit. If there are two branches come out like this [showing], cut out one of them, and let some come out below; if you do not, you will lose the other. Now, after the first year's growth you will find several little branches run up, all the way from one foot to four, and whenever it becomes prudent in pruning them, I cut them down to three in number and cut them off

to about a foot long; that is to say, if there are five shoots that run up, if I have courage enough I cut off two of them and leave three, cutting them off to about a foot, and so arrange them around the tree that they will not form this close union or close growing together and split down when they become loaded, and so that each one will act independently on the stock from the other. Next year you will find a still larger growth of three or four or five feet running up from these three spurs, and you will find all the way from three to five shoots on each one of those, and you will find two that look very much as though they were coming out the same, one running out of the top and the other coming out of the bottom. Now, the general disposition is, if a man does not study it, to cut off the upper one, which will leave dead wood with the lower one, and if that grows heavily it will bear down and will split through that dead wood. Though your trees will not look quite so well, do not cut off this upper one; cut off the lower one, and then the other one may swing to the ground—you may take hold of the top of it and pull it down to the ground and it will not split, but if you cut it the other way and at any time during the season pull it down, it will split. I cut on those stalks to two, and if you have three the first year, you will have six the next, and then out of those six there will be from three to four to each one, making eighteen to twenty-four, as the case may be. Now, pursue the same process the third year, leaving them about eighteen or twenty inches long, and by clipping this back each year you get strength of wood in the trunk of your tree. I prune in this way till I get up to four years old. I prune the fourth year and prune none after that, except where limbs are intertwining, or where there are four or five shoots come out of one. I just cut off two or three of those, leaving two, because they will all run out fruit spurs and the next year bear fruit, and if you have more than two, they will bend down and inevitably break some of them. Two will be enough, and that will give you from twenty to thirty shoots to bear fruit, which is enough. In the years following the fourth year I am adopting this plan: that you cut out some of these shoots which run up, and then others that come out will not interfere with the limbs, nor chafe. You want to cut them thin enough so that the fruit spurs which come out of the sides of the large limbs will have room enough to grow, bear, and protect themselves, so that there will be no occasion nor necessity of this limb becoming entirely barren from too much wood or too much leaf growth. If you notice other trees, you will find some that are very thick; that the fruit spurs are all off as high as this [showing] in the center of the tree. This is the result of the tree being too thick, as I understand it, and there being no opportunity for growth. At first I did as everybody else did. I pruned my six-year-old trees, cut them back at the top, and the result was I got no fruit. As good luck would have it, one year we were checked by laziness or by running about and doing other people's business, or by something, I do not know what, but we did not get around to prune our orchards, and there were four acres of the largest trees left until the blossoms had got out so far that it was unsafe and imprudent to prune them, and had to leave them for the next year. The result was I got a little over forty tons from four acres with seventy-five trees to the acre, twenty-four feet apart—and unless you are too selfish, I would advise you not to plant any kind of trees less than twenty-four feet apart, unless you can irrigate. If you get ten tons of



fruit from one acre, it seems to me you are pressing the land about as hard as you ought, for if you get three tons of hay you think you are destroying the land almost, and you ought to be satisfied when you get five or ten tons of fruit, with the growth necessary to sustain it. As I say, I got forty odd tons of fruit from four acres; that was in 1891. This year I got more fruit from that four acres than any other four acres that I had, and I had twenty-seven acres in bearing trees, so that it does not appear that the drain upon those was too great. We are only keeping up the thinning now. Those trees were seven years old before I got any fruit, because, as I believe, I kept cutting them back and for some reason unbalanced the growth of the trees in some way so they would not produce fruit. Now I have adopted the plan of not pruning after the fourth year and I get a good crop of fruit and a good-sized tree in the sixth. That is my plan on prunes. As to peaches, I have raised peaches enough on my trees; they are not yet very high, and being naturally lazy I work for the purpose of punishing my laziness. I don't like to climb, and if there is anything I can do to prevent it, I do it, and I do it by cutting off the up-shooting limbs on my peaches. I have also pruned in the same way the few pear trees that I have. In the apple trees, as I only have a half dozen, and I want them to grow so small that they will not be fit for market so that I can make myself a good drink of cider, I let them run as they will, and got thirty boxes, of forty to fifty-five pounds each, off of one tree one year. They are not very large to be sure, but they would have been larger if we had had more water; however, they made very good cider. Now, my impression is that the peach tree wants to be pruned after the buds have so thoroughly started that you can tell the difference between your fruit bud and the bud that simply will grow wood. Cut off a portion of this year's growth, and then cut the others back so that there will be two or three fruit buds to furnish fruit. I have been able, until this last year, to get somewhere from seven to eight tons to the acre of the very best quality of fruit, of good size, so that even the canners have found no fault and never weighed a pound back.

MR. ADAMS: Is it true that the prune drops as much from the young trees, which have not overborne, as from the older ones?

COLONEL HERSEY: I don't know about that. My crop was very small from young trees; the blossoming was very fair. Whether or not it was the cold that caused the dropping about the time they got the size of a wheat or barley grain, I do not know.

MR. ADAMS: The gentleman suggested that the dropping was caused by the large trees overbearing for a series of years.

COLONEL HERSEY: I had the best crop this year from my oldest trees, and my trees are ten years old.

DR. A. E. MINTIE, of San José: I have been through the orchards this season a good deal, and found that the complaint is just as much of the dropping from the young trees as from the old ones. I noticed particularly that the young trees suffered just as much in that line as the old ones.

## PRUNE CULTURE FROM A COMMERCIAL STANDPOINT.

By J. E. GORDON, of San José.

Many years ago a humorist with a world-wide reputation being asked for his advice to those contemplating matrimony, boiled down his answer to the one word "don't," and my advice to the grand army who are about to enter the ranks of the prune growers in search of a fortune, is equally brief and sententious—don't. The humorist's advice has not been heeded, and men and women are constantly entering into the bonds of matrimony, notwithstanding the fact that the newspapers tell us that marriage is a failure and a lottery. The fact that it is a lottery seems to be one of its chief attractions, and the same fact is equally true of the prune business in all its stages, from its inception in California's sunny nurseries until it reaches its grave in the stomachs of our Eastern brethren. My sincere advice, therefore, to nine out of every ten who would forsake their present avocations to enter into this untried field is, briefly, *don't*; but to the tenth, who may possess all the qualifications necessary to insure success, the following facts may be of value:

In the first place, don't enter our ranks under the impression that we are lonely; on the contrary, the fruit industry, of which the prune is an important element, now numbers, assuming 40 acres to be an average orchard, five thousand producers, to say nothing of the thousands of distributors, and it has passed our gold and grain production, and become the leading industry of the State. Eight years ago, when the writer entered the business, California's prune product was hardly a million pounds; last year I handled over a million pounds myself, which was scarce a thirtieth of the whole.

Don't engage in this business unless your heart is in it; unless you are fitted for it, and prepared to stay by it.

Don't listen to the oily tongue that would assure you that you can live in San Diego or Alaska, and run an orchard in the Santa Clara Valley, because it cannot be done successfully. It is worthy of, and needs, your undivided personal attention.

Don't go into the business unless you have ample capital to buy a healthy bearing orchard, or wait for a new one to come into bearing. The trials, losses, and disappointments of the multitudes who have tried to raise an orchard without the means to do it properly, make too sad a picture to portray, and we will pass it with the simple reminder, don't go and do likewise.

The writer came here eight years ago seeking rest from the excitement of a wholesale mercantile business in San Francisco, not knowing a prune tree from an apricot, and bought the highest priced bearing orchard in the county. It was an orchard set out by business men, on business principles, and under proper conditions, and has always paid a good interest on \$1,000 per acre, and he has never regretted the act, and to those who are able to do so this is a practical solution of the prune problem.

Now, as to the capital required, it will depend of course on the scale upon which you wish to operate. In this county, land near the railroad is held at \$200 per acre; five to ten miles back, at \$100. The highest priced is not necessarily the best, often the reverse, and under no circumstances should you pay to exceed \$150 per acre for level valley land,

because the future of the industry will not warrant it. Cost of trees, planting, and cultivation first year, \$30, or say \$180. Five years must elapse before a crop can be obtained, at an annual cost for cultivation of \$10; taxes, \$2; interest, \$20; sundries \$3; or say  $\$175 + \$180 = \$355$  per acre, besides cost of living, and provided your trees all grow and have no set-backs.

Having a love for the business and the necessary capital, the most important consideration will be choice of location. Don't be led away by the idea that you can raise as good prunes in one part of the State as you can in another, because you cannot. Every green fruit shipper in the State knows that the best pears come from one district, the best cherries from another, and our own San José canners know that when we would compete for the best peach trade, we must seek the fruit outside of our own county. For the same reason, it is a notorious fact that the best prunes in the world are produced in the Santa Clara Valley, and particularly in that part near Los Gatos, Saratoga, and Cupertino, known as the west side. Every intelligent horticulturist must admit that foothill prunes grown without irrigation are much superior to those grown in the valley, whether irrigated or not, on account of their greater percentage of sugar and fruity flavor. When our driers buy prunes grown in adjoining counties and mix them with our own, their inferiority is so marked that they rarely repeat the experiment. The loss by shrinkage is much greater, and the flavor so insipid, that it does not pay to handle them. This is equally true of the irrigated valleys of Southern California. Ten years hence the prune grower of Los Angeles will wish that he had stuck to his orange groves, and the residents of Tulare will realize that the very conditions which render it the natural home of the raisin, make it equally unprofitable for the prune. There is no personal feeling in this statement, because, although the writer's home is in Santa Clara County, he has large interests in Tulare County, and has unbounded faith in its resources, but not as a prune center. Herein lies a source of great danger to the prune industry, because thousands of orchards are being planted in unsuitable locations, which in a few years will be producing millions of pounds of inferior fruit, which will bring down our good fruit to a price leaving but a very small margin of profit. We must then cease to sell our product as California prunes, but under a name which the markets of the world will then have recognized as a type of the highest excellence, that of "Santa Clara" prunes.

Having decided to locate in Santa Clara County, don't buy a piece of land because it is widely advertised. While judicious advertising is both proper and profitable, yet we all know that the greatest humbugs are always the most widely advertised, and this is particularly true in land deals. Don't be in a hurry; carefully examine the soil and characteristics of each piece submitted; compare the growth and condition of adjoining orchards with others you know to be good. If there are no adjoining orchards let it alone, unless you can afford to experiment in untried fields for your country's good. Over 50,000 prune trees were replanted this spring near Hanford, Tulare County, to replace those dying from too much alkali. What a world of toil and trouble might have been saved had they been planted in this valley.

Don't pay a high price because it is near a railroad, because your crop is not perishable and is not sold green or to a cannery, but will be sold to the nearest drier, or dried by yourself, and a few miles' haul is not



an offset to a high price for your land, particularly if the price of fruit be low. The price named, \$150 per acre, is high enough; \$100 would be better, and good land can be had at that figure. In choosing a location climate is a potent factor, second only to the character of the soil, and only when the two are properly united can we secure a perfect prune. Prunes will grow all over California, so they do all over Europe, but we all know the marked difference that has always existed between Austrian and Turkish on the one hand, and French on the other. As the finest prunes have always been produced in the valley of the Lot in southern France, so we find the same conditions in the contour of our Santa Clara Valley, its distance from the ocean being such as to aid in producing that long, even temperature and slow ripening which are all important in developing the saccharine and imparting the flavor so essential in a first-class prune. The greater rainfall in the extreme north of California, Oregon, and Washington, and the excessive moisture causing the fruit to split and crack, shrivel, and lose its flavor, renders these parts unfit for the cultivation of the prune. The same remark applies to such parts of Southern California where excessive irrigation is practiced, and refers to the French prune of commerce only. Italian and perhaps Silver prunes may be grown under such conditions, but these are not under consideration. Oregon and Washington can never compete with us for another reason: they are obliged to use driers, while we can cure in the open air by the direct heat of the sun, which imparts an aroma or bouquet which no artificial means can equal.

Having bought a suitable piece of land, don't think all you have to do is to scoop out holes 20 feet apart and stick in trees, but plow, plow the whole tract, the deeper the better; it may cost you \$5 or even \$6 per acre, but it will come back to you in fruit an hundred fold. If you can raise a crop of corn or grain before planting, all the better, but don't plant any crop between the trees to deprive them of nourishment, particularly hay or grain; corn is least harmful, and shades the trees.

Don't be so foolish as to buy cheap trees. Of all follies, this is the greatest. Don't buy Eastern, or Oregon, or other outlandish trees, but go to a reliable California nurseryman, or some neighboring orchardist, many of whom raise a few thousand every year for sale. Don't buy two-year-olds, but wait until you can get one-year-olds.

Don't make the mistake of planting your trees 15 feet apart because you can get nearly 200 to the acre, while at 20 feet you can get but little over 100. An acre will not support 200 trees, and they must necessarily die young; 20 feet is near enough, 25 feet is better.

Don't plant your trees until you know that the stock and soil are adapted to each other.

Prune, budded or grafted on peach stock, in a light, warm, sandy soil, will do well—and is the usual conditions—while on damp, clay ground only the Myrobalan, or wild plum stock, has so far been successful. On heavy, dark, alluvial loam, slightly gravelly, almond stock is better—bitter almond if possible—and is the best of all for our foothills, where deep gravelly and sandy soil abounds; irrigation is not necessary, as the almond root reaches down to moisture and thrives where the peach root would die.

Don't be induced to try German, Italian, Silver, or other varieties for which there is no market—especially the Silver prune, which came to us from Oregon, and to whence, by all means, let it return. The prune

of commerce, known as D'Agen, was first planted near San José by Louis Pellier, in 1856. The first orchard of the same to attract attention was the Bradley orchard, near San José, and the next and possibly better known was the O'Banion & Kent orchard, near Saratoga, now owned by the writer, under the name of Miramonte. There is a variety of this prune improperly called Robe de Sargent, which is but a synonym of D'Agen. The real name is D'Ente, and the fruit is known by its dark color when dried, its glossy surface, requiring but little dipping, and its slight acidity, which, like the German, causes it to be preferred by many. The prune-growing district of France is a little larger than our Santa Clara Valley, but has six times the population. Agen is the town from which most of the prunes are exported, and corresponds to San José in this country. There are no commercial orchards, as we have here—one acre is a good size farm, and the prunes are carried to market in baskets on the heads of the women, and sold to dealers, who pack and ship the medium and small sizes, retaining the large ones for home trade. Their net profit varies from \$30 to \$60 per acre, the larger returns being always from the foothill farms, as in our own case.

One reason for the superiority of our prunes is that we always propagate from seedlings, while in France the rule is to propagate from suckers—the very worst system possible. Under these unfavorable circumstances, and their exhausted soils, the life of a prune tree is twenty-five to fifty years, so the croakers who think our oldest orchards (fifteen to twenty years old) are ready to die, will probably die themselves before their predictions are verified.

Don't believe machine drummers, who assure you that the latest patent cultivators will keep your orchard in perfect condition. They are usually nuisances, soon finding their way to the junk shop. Stick to your plow; plow every year, not every other year; then harrow and clod-mash, and you will have done a job to be proud of. Nothing has yet been invented to beat the old reliable plow and harrow.

Don't allow any weeds to grow, and keep your soil so thoroughly pulverized that when the ripe fruit drops it will not bruise. Such thorough cultivation renders irrigation unnecessary, except in a year of light rainfall. One good wetting down during winter will be of benefit, but summer irrigation is of but little value.

Don't get rattled on the subject of pruning, which has proven a most prolific breeder of cranks—no two alike. Prune; prune when the trees are young; prune when they are old; never, of course, to excess, but until you have a stout, stocky trunk, capable of sustaining large crops without bending or splitting, and not liable to die easily; then keep on pruning, and you will never regret it. A magnificent tree, with its branches sprawling all over the ground, and splitting and cracking under its load, is a scene so shiftless and degrading that we will not dwell on it.

Don't get scared about pests. Like the measles, you are sure to have them sooner or later; but prunes are less troubled this way than any other fruit. Considerable capital is invested in drugs and spray pumps, but nothing has yet been found to equal nature's remedy—the parasite known as *Chilocorus bivulnerus*, or twice-stabbed ladybird.

If you must spray, don't buy any patent mixtures from unknown advertisers, but buy pure drugs at wholesale, and do your own mixing.

Don't get excited and think you are ruined when the prunes begin to



drop in the spring. Let them drop; get in and help them drop some more; it is nature saving you the expense of thinning, and what are left will be larger and better for it.

Don't listen to the tree agent's statement that the demand for prunes is practically unlimited, and will tax the entire prune-growing area to its fullest extent to supply. Give me the product of the Santa Clara Valley and I will supply the whole world. It has a tillable area of a quarter million acres, which, at only one ton to the acre, would produce 500,000,000 pounds, nearly ten times the present consumption of the United States. Don't spend too much time ascertaining the condition of the crops in France or Turkey. The American apple crop is the true barometer of our prune market. When there is a good supply of dried apples, our Eastern sisters in their marketing don't care if our prunes are 5 or 10 cents per pound, but when there are no apples they must have prunes, and as we have always compelled them to pay a round price, it is not surprising that they are not more popular; because 10 cents to us means  $12\frac{1}{2}$  cents to the wholesaler, 15 cents to the retailer, and 20 to 25 cents to the consumers, and they cannot and will not stand it when they can get a substitute. The French crop of 1890 was the largest for nearly twenty years—40,000,000 pounds—while the average for that period was only 20,000,000 pounds, or about the present California average, and after trying during the last two years to retain their hold on American markets by mixing their product with ours, and imitating our packages and labels, they have practically surrendered and are seeking other markets. During the season of 1888, the writer took an active part in a well-concerted movement to bear the market for the purpose of securing a wider distribution, and succeeded in arousing the enmity of many who snubbed him by saying they wanted no 5-cent fellows coming around. The result was a success. Prunes sold at 4 to 5 cents per pound, were sold East way below any former price, found their way into the mouths of thousands who had never tasted one before, and caused such a demand that the foreign were driven out, and the large yield of 1891 readily marketed, and those 5-cent fellows had more to do with the present condition of the prune market than the much talked-of tariff.

Don't expect a crop in three or four years, and when you do get one don't expect 1,000 pounds to the tree. We read of such things down South; but overwork a three-year-old colt and you will have a horse fit only for the boneyard. Apply the same principle to a prune tree and you will soon have an excellent quality of firewood. It stands to reason that life cannot be maintained under such a strain.

Don't be deceived by the report that Jones of Napa, or Brown of San Bernardino, sold his crop at the rate of \$500 or over per acre. He may have had but one acre, or under unusual circumstances secured that price one year for a few acres, but don't go to figuring out 10 acres at \$500, and expect \$5,000 per year off of every 10-acre lot in bearing, or you will come to grief, and deservedly so. A properly trained and cultivated orchard, after its sixth year, can be expected to produce annually an average of 100 pounds per tree, or 5 tons per acre; average price last five years, \$40 per ton, or \$200 per acre. A liberal deduction for cost of production, including taxes and interest, is \$75, or \$125 per acre profit, being 10 per cent net on \$1,250 per acre, or 30 per cent on actual cost. Don't flatter yourself, however, that this state of affairs is to continue; on the contrary, the average the next five years will not be over \$20 per



ton, or \$100 per acre, while the expenses may be kept at \$60, or say \$40 per acre profit, or 10 per cent net on actual cost. This is better than most mercantile ventures, and should satisfy any reasonable man, but it can be obtained only under the favorable conditions herein set forth. Thousands of acres have been and will be planted that through ignorance and bad management will never produce a paying crop; and it will be in this as in every other department of life, a survival of the fittest. Those who understand the business and attend to it are likely to make money out of their superior goods, even at the very low prices that are likely to rule in the future.

When your crop is ready to harvest you will find but one way to handle it, viz.: to dry it. It can be canned, but is not salable in that form, and there is no demand for the fresh fruit.

Don't be in a hurry to harvest your crop. Men have been known to knock off the fruit with sticks and clubs, and shake the trees to their very roots. Such prunes when dried would pass for shoe leather. Let the fruit remain on the tree until ripe enough to fall of its own weight, or by a very slight jar.

Don't dry your own fruit. Don't listen to your neighbor, who dried ten tons and sold for 10 cents, when he could only get 2 cents green. Take the last five years, or since we have had prunes to sell, and the grower who has persistently sold his crop green to the nearest drier and balanced his books in September is way ahead of the speculator who wants every cent there is in it, and won't give the other fellow a show. We are born speculators, and the same spirit which induces us to take our chances in the great California lottery of prune growing makes us hold our crop to take the chances of the market. I never knew an intelligent farmer who did not admit that prompt sales of any produce when ready for market, netted the best results, and prunes are no exception to the rule. When the farmer or grower passes out of his domain to enter that of the commission merchant, he usually comes to grief. The driers have been the best friends the grower ever had or will have. They were our friends and neighbors, risking their all, at all times paying the highest prices, and with one or two exceptions paying promptly and fully. And what have they met in return? Not even common courtesy, but abuse and misrepresentation, causing many to fail outright and many more to remove their business to Tulare and other newer fields, where let us trust they may be better appreciated. The result will be we will be brought nearer to the consumer—one middleman less, but the one we can least afford to lose. The Eastern buyers and their agents will build stately warehouses along our railroad tracks, at our expense, fix the price they will pay, and divide the crop between them. This they can readily do, because if every man is to dry his own crop, there will be no uniformity, the lowest price paid to all, and the buyer get all the benefit of the careful grower's extra quality. They will then lay down the law after this fashion: 1 cent per pound green pays you a profit; three pounds will make one of dried and cover all expenses, therefore we will pay you 3 cents for your dried prunes. Where will our friends be then, who have been sitting up nights figuring out their fortunes on a basis of 10 cents per pound?

A partial remedy for this condition of affairs lies in coöperation, a combination of ten or twenty growers for the purpose of drying and

marketing their crop. But this relief is only temporary, only while good prices can be had. Let one or two poor years ensue, and the managers will be accused of every crime under the sun, and be glad to retire in favor of others, probably less competent, who will soon wreck the association. It is a saying that when a man makes a failure of everything else he opens a real estate office, and accounts for the prejudice so many entertain against such dealers, and the same remark can be applied with greater truth to fruit growing. The percentage of intelligent growers who attend our conventions, keep posted, and understand the needs of the business, is small, and it is not surprising that such heterogeneous elements cannot be brought into one harmonious whole. A better solution of the difficulty lies in an exchange, such as the Santa Clara County Fruit Exchange. It ought to be an easy matter to convince one hundred men, each having 10 tons of prunes to market, that it is better to allow the exchange to offer 1,000 tons for sale and sustain the market, rather than have one hundred men, with a pocket full of samples, wear the life out of the limited number of buyers and break the market all to pieces in their anxiety to realize. A plan of such an exchange is before the growers of this valley, and the only comment necessary, is that it meets the approval of all the practical business men who have investigated it. The advice not to dry your own fruit is therefore well founded when applied to the majority of growers owning from 10 to 30 acres; but some of us have 100 acres or more, in which case we must be prepared to do our own drying, and even a step further, be our own salesmen.

Under the circumstances, a few directions as to drying may not be amiss. Don't economize as to necessary modern implements. Don't, I beseech you, dip your prunes in an old iron pot, where the mud is so thick you can almost cut it with a knife. I have seen this done, even this very year, in an establishment that claimed to produce first-class prunes, and I don't know who I pitied the most, the proprietor or his customers. Have some regard for the latter, and use plenty of flowing water. The best machine for this purpose is the Cunningham dipper, which has two compartments, the first containing boiling lye, which must be kept boiling by means of steam coils. The prunes drop through a hopper onto a draper, which carries them up and over into the next compartment, filled with cold water, and out of that drops them on trays 3x8, holding about 80 pounds to the tray, which can be handled by two men, and are more economical than 2x3 trays handled by one man. The drying is facilitated by grading into three or four sizes as they come in from the field, but this grading should not prevent grading after they are dried, as buyers are getting very captious and insist on exact grading, the slightest variation being seized upon as a pretext for rejections and reclamations, except in years of scarcity, when everything goes. Chicago has been our largest customer, and at the same time the most unprincipled, going to extremes in this matter which no other city has dreamed of. Slow drying, like slow ripening, is essential to quality. A prune that takes a week to cure is far superior to one that dries in two days—another objection to prune culture in our hot valleys of the interior. A climate free from fog is also desirable, so that the trays need not be stacked every night. They are sufficiently dried as soon as the water is all evaporated, but should be soft and pliable and not rattle, unless you are going to ship them to Chicago, where they want them as

dry as gravel stones, so they can turn the waters of Lake Michigan on them to their greatest advantage.

You now having escaped the Scylla of the business, stand confronted by the Charybdis, a monster that would rob us of all the benefits we have secured up to this point, and give them to the middleman, and that is the kind of package in which to ship. Don't make the fatal error of shipping in bags. It is a device of the devil, concocted in Chicago, compared to which the tariff scare sinks into insignificance. You cannot look to your commission merchant for help in this strait. He will stand by the buyer, because his commission is easier earned by that course than by working hard for a better price for a better article. Any fool can sell a man what he wants by cutting the price, but it takes a smart man to sell him an extra quality, well packed, and such men are very scarce in that business. By selling in bags you lose your identity. The dirty, dusty bags, with juice oozing out of them, are no addition to a well-kept store; are cut open and thrown away, while an attractive box and label is a perpetual advertisement of your name and locality. By selling in bags you open the door to frauds in grades, weight, etc., after they have passed out of your control, which is not possible when properly packed in 25-pound boxes. By selling in bags you lose any advantage in quality your prunes may possess, for in that shape a prune is a prune, and the skins and pits of irrigated districts, raised at one half the cost of yours, are mixed and sold as California prunes, which may thereby in time sink to the level of Turkish prunes. The sole object of buying in bags is to adulterate with inferior California and foreign prunes; and secondly, to soak them with all the water they will hold, that the increased weight may cover cost of boxing in packages that may advertise their business, not ours. Last year the writer was offered a high price for his entire pack in bags by a French firm, who wished to pack same under French labels, but the offer was declined, for that reason only. At least 90 per cent of the product of a first-class orchard should range from fifty to ninety to the pound, and should be carefully packed in 25-pound boxes, under an attractive trademark; the balance may be sold in bags. If your commission merchant cannot sell them in boxes, find one who can, or if necessary be your own commission merchant, which the size of your business will warrant. I do not wish to detract from the value of the commission merchant as such; on the contrary, I believe in employing them, and very cheerfully pay the 5 per cent they charge, which includes guaranty of all sales, and relieves you of the detail of distribution, which you cannot do for 5 per cent; but let the services end here. When you undertake to make them your bankers, you commit a fatal error. As you value your life, your liberty, and your property, don't let any commission merchant own you. Get what advances you need from your banker, and if you cannot, better sell out to some one who can; you will never regret it. In seeking a market for boxed goods, waste no time on Chicago. You can do better in New York, Boston, or Philadelphia. Go East yourself, and by personal contact become familiar with the wants of your customers. One such visit is worth years of correspondence.

Don't be in a hurry to ship your fruit in September—such fruit is not cured fruit, and reflects no credit on grower or seller. It should lie in your packing-house several weeks, to go through the sweating, or equalizing process; and the latter part of October is soon enough to ship, if



quality be an object, and if you wish to avoid the danger of rejections, which are sure to follow such shipments. It is argued that our prunes are too sweet, but this is a good fault, and really makes them a very economical article, because the consumer, in buying his fruit gets his sugar with it. It is a common saying that prunes are the poor man's fruit, owing to the low price at which they are sold, but were it not for the sugar they contain they would be the dearest. Take, for instance, this year's price, 9 cents; one pound soaked and cooked equals three, or, say 3 cents per pound, while one pound of peaches or apricots at 14 cents—or, if cooked, seven pounds—equals 2 cents per pound. Very few, probably, have figured this out this way. We find, then, that foreign prunes are inferior to ours because they are largely propagated from suckers, while we use seedlings; theirs are raised on soil worn out a hundred years ago, while ours is practically virgin soil; theirs are cured during the rainy season in ovens and driers, cooking same, while ours are dried in the open air by the sun's rays, and have to be cooked but once. It is not surprising, therefore, that we have secured the home market, and are likely to retain it, tariff or no tariff. Now that the election is over, a Republican may be able to state that the tariff is of but secondary importance to the prune grower, without being called a traitor. If the 2-cent duty be so vital, how can we consistently explain the columns of reports of \$500 to \$600 profits realized all over the State? If the duty were removed entirely, which I hope will not occur, we can still make money under proper conditions, if we get but \$20 per ton instead of \$40 to \$60, as has been the case for several years.

The California State Board of Trade, through its Chairman, Gen. N. P. Chipman, has sent forth the statement that we can raise fruit cheaper in California than in any other place in the world, and the reasons have just been stated. And although we have no export trade now, the time may come when we can send our coals to Newcastle, even with the duties levied by France and Turkey; and then let reciprocity take the place of tariff, and California will hold her own in the markets of the world, and get rich at it.

The greatest danger lies in the continued reckless planting of more trees, when enough—in fact, too many—are already planted. There are about 20,000,000 growing deciduous fruit trees in California, of which at least 5,000,000 are prunes, which, at the very moderate estimate of 100 pounds per tree, will produce 200,000,000 pounds of dried prunes. Now, what are we to do with them. They are not a luxury, but by no means a necessity; even the growers themselves rarely have them on their tables. Their mildly laxative and slightly acid qualities aid in keeping our system in order, but only a limited quantity are purchased by any one family, say one 25-pound box to each. The population of the United States during the last decade has averaged 60,000,000. The usual average of five persons to each family would give us 12,000,000 families, each consuming 25 pounds, or say 300,000,000 pounds. But we cannot count on this, because millions of families do not care for and never buy them. What we do absolutely know from the National Bureau of Statistics is that for twenty years prior to the advent of California prunes the total consumption was about 30,000,000 pounds per annum, which, through the popularity of the California prunes, we have increased during the last eight years to 70,000,000 pounds, or a little over one pound per capita. Our population is

increasing at the rate of one and one half million yearly, which ten years hence would give us, say, 80,000,000 population, and at the same rate require 15,000,000 pounds more, or say 85,000,000 pounds of prunes. But assuming that we so push matters as to quintuple this normal increase, and we would then require 145,000,000 pounds, while we now have enough planted to give us 200,000,000 in less than five years. Surely, it is time to call a halt in this wild boom, and turn our thoughts to other fruits now neglected, but equally profitable. Our only consolation in case of such a glut is that prunes make excellent hog feed, and one acre of prunes will produce more pork than one acre of grain. From the same bureau of statistics we learn that the average price of imported prunes for twenty-five years has been 5 cents, which, if maintained, would mean to us 4 cents, when the rail freight is reduced to 1 cent, which it will be soon. As already stated, 4 cents will give us all a very fair bank account, so we have not so much to fear in the way of price if we can stop further planting. Of course, thousands of trees that have been improperly planted will die or be abandoned, but they will not offset the additional planting that will certainly continue year after year in spite of statistics. It is said that children and fools always tell the truth; if so, the gray hairs produced by the vicissitudes of business would indicate to what division the writer belongs. A truer maxim, however, is that "Truth is mighty and must prevail," and "Truth crushed to earth will rise again," and though he be crushed beneath the avalanche of land sellers and tree sellers, he will lay aside his pen with the consciousness of a duty done, and that future conventions, in recalling the records of this one, will say: "Well done, good and faithful servant."

MR. MOTHERAL: I do not object to the gentleman's statement about Santa Clara prunes, but I do object to a part of that statement that they have more sugar in their prunes than we do in Tulare and Fresno Counties. The facts are that we have the richest raisins in the world, for the reason that we have more sugar, and I would like to ask anybody as to whether it is a fact that we get more sugar in our raisins and less in our prunes. The conditions are the same. We certainly could get just as much per pound, per tree, per acre, as they can in Santa Clara; and I would like any gentleman to answer the question, as the saccharometer tells the truth, if we are behind anybody. While I am not here to boom Tulare, for we have boom enough, I would like to be put on record for saying that Tulare County is the prune county of the State.

Recess.

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## XVIII.

### AFTERNOON SESSION.

#### REPORT OF COMMITTEE ON RESOLUTIONS.

JUDGE AIKEN, on behalf of the Committee on Resolutions, to whom was referred the following resolution, offered by Edward Berwick: "Resolved, that this convention demands the immediate construction of the Nicaragua Canal by the United States Government for the free use of the American people, and deplore the intervention of any company, as cal-

culated to thrust one more monopoly, the greatest of the age, on a long-suffering people," presents the following report, which, on motion, was adopted :

SAN JOSÉ, November 18, 1892.

*To the Fruit Growers' Convention:*

The Committee on Resolutions respectfully report upon the Nicaragua Canal resolution, submitted for consideration, the following memorial to the Congress of the United States:

*To the honorable the Senate and House of Representatives, in Congress assembled:*

Your memorialists, the fruit growers of the State of California, in annual convention assembled, at the City of San José, on this 18th day of November, 1892, respectfully represent that they are engaged in the production, preparation, and marketing of fruit to supply the demand in this and foreign countries.

That better and cheaper transportation facilities than now exist are of the first importance to the continued growth and prosperity of the fruit industry.

That your memorialists heartily commend to your consideration the making and early completion of the Nicaragua Canal, to be controlled by the Government, in the interest of the people of the United States and the commerce of the world.

That upon the adoption of this memorial copies be furnished the California congressional delegation.

W. H. AIKEN,  
Chairman Committee on Resolutions.

The Committee on Resolutions also presents to the convention their report on the preamble and resolution proposed by E. E. Smith, which, on motion, was adopted :

SAN JOSÉ, November 18, 1892.

*To the Fruit Growers' Convention:*

The Committee on Resolutions having under consideration the resolutions favoring the establishment of a Division of Roads of the Department of Agriculture at Washington, D. C., have the honor to report the following memorial to the Congress of the United States:

*To the honorable the Senate and House of Representatives, in Congress assembled:*

Your memorialists, horticulturists of the State of California, assembled in annual convention at the City of San José, this 18th day of November, 1892, respectfully represent, that the establishment of a "Division of Roads" in the Department of Agriculture at Washington, D. C., would meet with their unqualified approval, and be of great benefit to the people in well-directed efforts of road making, so much needed in this country.

That this memorial, upon adoption, be sent to the congressional delegation from California.

W. H. AIKEN,  
Chairman Committee on Resolutions.

JUDGE AIKEN, Chairman of the Committee on Resolutions, reported back the following resolution offered by Mr. Berwick: "Resolved, that this convention believes that it is for the interest of the fruit growers of California that the United States Government should purchase and operate all existing transcontinental railroads," with the following report:

SAN JOSÉ, November 18, 1892.

*To the Fruit Growers' Convention:*

The Committee on Resolutions, having given the subject of government ownership and control of railroads due consideration, have the honor to report:

The ownership of railroads is not the established policy of the Government of the United States, and the adoption of such a radical measure is too remote and uncertain in its beneficial results to warrant its serious consideration at this time.

W. H. AIKEN,  
Chairman Committee on Resolutions.

Also, reported back the following resolutions: "Resolved, that this convention believes that the best interests of the fruit growers and of all classes of citizens in California would be subserved by the disbursement of government funds in railroads and means of transportation, rather



than in the building of additional ironclads for offensive and defensive purposes. Resolved further, that these resolutions of this convention be sent to every United States Senator and Member of Congress, requesting them to do their utmost to forward such legislation as shall fulfill the wishes of the people herein expressed, and the Secretary of the State Board of Horticulture is hereby directed to carry this resolution into effect," with the following report:

That better and cheaper service on the part of existing corporations, and increased facilities of transportation by land and sea are of present and paramount importance, and efforts in these directions should receive the hearty support and encouragement of the horticulturists of the State.

W. H. AIKEN,  
Chairman Committee on Resolutions.

#### REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.

##### *To the members of the Convention:*

Your committee to whom was referred the address of the President, consider the subjects therein treated of such vital importance to the fruit growers of California, that they will be treated in detail, as follows:

*Annual Meetings.*—In regard to the objects of the annual meetings of the fruit growers of the State, we are fully prepared to say that every meeting substantiates the language of the address, and we can find no words better adapted to express our convictions than by quoting almost verbatim from the address, as follows: "The harmony, unity of feeling and purpose always present, and which have in all instances governed our deliberations, are creating a public sentiment, and on our maintaining the same unselfish interest in the general welfare will eventually become a controlling factor in our State affairs."

*Fruits.*—The pleasure experienced and appreciated in viewing the new and improved methods employed by the fruit growers of the State is in some degree destroyed by the fraudulent packing and false labels pursued and made use of by a few of our producers or packers, and we believe the subject of such widespread importance that it demands consideration by this convention, and unless discontinued will call for the creation of a Department of Fruit Inspection, which will effectually suppress this unmitigated evil.

*Parasitic Insects.*—In regard to the search for and importation of insects which will destroy the parasites which infest many of our orchards, we cannot too strongly urge its importance, and believing as we do, that nature has created parasitic insects which will hold in check, if not ultimately destroy, many if not all of our insect pests, for this reason we fully concur in the recommendation that a special committee be appointed to present the matter to the State Legislature, and urge in the strongest manner possible an appropriation of \$5,000 per year for four years for this purpose, and that the services of Mr. Albert Koebele be secured, and that he be sent to such places as may offer any possible opportunity for procuring such beneficial insects as may protect the grower of any product from insect pests.

*Forestry.*—Effective laws should be enacted by our National Legislature for the protection of our forests, or their reproduction, when the necessities of consumption require their destruction. This important matter should be in charge of a special committee.

*Olive Oil Adulteration.*—Further congressional action than that recommended for the protection of our forests is recommended for the protection of the olive oil industry (which to-day is in its infancy) against the atrocious adulterations which are being practiced, and a product placed upon the market which at once not only degrades the olive oil industry as a business, but is productive of disastrous consequences to the human family, as was fully shown by scientific essays read before the Convention of Olive Growers which assembled in San Francisco on the 21st of July, 1892, and deliberated on this subject. To the transactions of this convention the fruit growers are respectfully referred. And to the end that adulteration of olive oil and all other food products may be suppressed, we most heartily adopt the recommendation of the President's address, and recommend such amendments to the "Pharmacy Act" as will absolutely prohibit the sale of all adulterated food products.

*Railroads.*—Your committee have not had the time necessary to fully present its views on the question of government ownership of railroads, a subject which requires the collection of a mass of statistics from countries which have adopted the system, and without which we are not prepared to recommend the change from individual or corporate ownership to ownership by the General Government. We are, however, prepared to recommend that in all future charters for railroads, such safeguard should be thrown around them that the interests of the people shall have such protection as will secure the lowest rates of freight and fare, and the most efficient service compatible with due protection to the owners of such roads.

We congratulate this convention.

WM. JOHNSTON,  
Chairman.

The report was, on motion, adopted.

## RESOLUTIONS THANKING THE PEOPLE OF SANTA CLARA COUNTY.

JUDGE AIKEN offered the following resolutions, which were adopted :

*Resolved*, That the fruit growers of California, in accepting the invitation to hold its convention in your city, would not do itself honor if a public recognition was not had of the hospitalities so cordially extended and so elegantly carried into effect.

*Resolved*, That the reception tendered the fruit growers by the citizens of San José was an unbounded success, and that its memories will long remain.

*Resolved*, That the successful efforts of the citizens to show to the many strangers the evidences of the vast capacity of this section entitles them to the thanks of the convention.

*Resolved*, That special thanks be tendered to the press of San José for its elaborate reports of the transactions of the convention, and particularly for the publishing (by the "Mercury") of entire papers and essays read before the convention.

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IRRIGATION FOR THE DEVELOPMENT OF FRUIT.

By HENRY A. BRAINARD, of San José.

In responding to the invitation to furnish something on this point which may be the basis of a possible discussion, I have taken the view that a general essay on irrigation was not intended, for such a field would be a broad one not easy to bring within the limits of what is permitted here; and I shall not, indeed, find space to more than present an idea or two on this special branch of the subject.

I shall suppose, to begin with, therefore, that we have an orchard of trees already grown to bearing either with or without irrigation, and the problem before us is to make it bear the most perfect fruit. It will really make a difference whether the trees have been grown up to this point with or without irrigation, whether we shall continue the same or not, for it goes almost without saying that if they have been irrigated up to this time that process must of necessity be continued; but this will not greatly alter a general principle, which we may state.

The fruit tree is a most wonderful laboratory; a most wonderful manufactory. It takes the crude materials from the air and soil, combines and manipulates them in a way so refined and mysterious that our brethren of the retort and condenser, of the test-tube, the blowpipe, and the microscope, are baffled in their attempts to understand fully just how it all happens. The results are well known, for they have been the foundation of an industry which has brought us all together here—results that feed millions and provide a support for millions more. The great medium by which all these crude materials are taken into solution and transported from the soil to the laboratory and from the laboratory to all the tissues of the growing fruit, is water. This very laboratory and manufactory is self-created (recognizing ever the great Creator who planned it all), and the very same conditions are required to create it as to continue the process and create the fruit. All these delicate operations require the further aid of warmth and sunlight. To adjust all these in most nearly perfect harmony is to produce the most nearly perfect fruit. When nature furnishes these in just the right proportions all is well. When water is lacking in the form of frequent raindrops from the skies or steady percolation through the soil, it must be supplied artificially; and this is irrigation.

The question of the need or desirability of this comes home to every fruit



grower in California, for in almost every section there are many months of cloudless skies; months of strong summer heat; months when we are surrounded by an atmosphere that is greedy for moisture and takes it freely.

The question of the necessity for irrigation depends very much on soil and circumstances. It has long been the pride and boast of Santa Clara Valley that within its charmed circle irrigation was not needed for the most perfect development of fruits. Abundant rains fall in the mountains on both sides in winter, and descending the slopes, this water sinks below the surface and flows underground in porous gravel beds, at various distances beneath the floor of the valley. It seems to exist there in vast reservoirs, and in a part of this section, where these reservoirs are pierced by the well-borer's auger, the precious store rises to the surface and from two to twenty feet above. In the valley itself there is usually a rainfall sufficient to thoroughly moisten the surface soil each year down to a depth where permanent moisture exists. Thorough cultivation keeps the soil in such a condition that it draws continually from the deep hidden sources, and the roots of the trees are in a soil perpetually moist. When this is the case, there is very little need for irrigation for the development of fruit. The millions of little absorbent rootlets in contact with this perpetually moist soil take up all they need; the tree grows vigorously, and the fruit steadily increases in size and weight from the ovary in the blossom to perfect maturity. Stores of starchy matter are elaborated and when the right time comes, the rich, warm sun turns them into sugar. We have then a perfectly developed fruit—all we can ask for or desire. Possibly the supply of an extra amount of water during summer might have induced a more succulent growth of tree—possibly it might have forced into the tissues of the fruit more water, causing it to become gross and misshapen; cause the peach to have a bursted pit, and the bitter flavor which should have remained in the seed kernel alone, become diffused throughout the flesh. This over-development we regard as quite as much imperfect as an under-development.

Suppose, now, that for some reason this condition of a perpetually moist soil about the roots fails, and there are many reasons why it may fail, then we see our beautifully organized workshop hampered in its work, and in many ways. There is not water enough to perfectly dissolve the materials in the soil to be carried to the leaves. The leaves lose their freshness, and with this loss they lose their power to absorb material from the air, which is even greater in amount than that which comes from the soil. There is a lack of the medium which serves to convey the elaborated sap from the leaves downward to every tissue of the tree and fruit. The result is an undeveloped fruit. Supply this lacking moisture in any way and we tend to correct the trouble.

There are many reasons why moisture may thus fail. In some sections the regular rainfall is never sufficient to moisten more than a few inches of the surface. Again, the structure of the soil may be of such a kind that the rain falling in the distant mountains is not conducted beneath and stored for time of need, as we have seen is done in Santa Clara Valley. The planting of thousands and tens of thousands of trees may make such drafts upon the natural moisture that it is, in a greater or less degree, exhausted. There may be some special conformation of the strata which prevents the steady circulation of the water which lies



only a little way below. Any of these conditions may create a need for irrigation to develop fruit.

We were not long ago called to examine an orchard situated on apparently the richest soil. In their early life the trees grew well and perfectly developed their fruit. Of late there had been a failure to a certain degree, as the dry season came on. Investigation showed that this fine, rich soil was only four to six feet deep, and that below it lay a stratum of gravel. While the trees were young there was moisture enough in the surface soil to cause a fine growth of tree and to ripen the fruit. But as the larger trees made more demands for moisture it was soon exhausted, and the stratum of gravel not only prevented the retention of water, which would have occurred had this layer been more impervious, but it also prevented the rise of moisture through it from below. In such a case the owner must irrigate to keep this top stratum of four to six feet of rich soil constantly moist, possibly turning on the water every two weeks after the rains of winter are exhausted.

In places exactly similar large, deep holes were dug to plant the trees, reaching clear down through the underlying gravel, and establishing a connection of soil of such a character as would readily conduct moisture from below, and in such orchards there has been no difficulty; but with the old orchard, planted without these precautions, we must irrigate.

On some of the rich mellow sediment soils which are fertile, porous, and deep, such as are planted with some of the famous cherry orchards of Santa Clara County, the best plan to develop fruit has been found to be to give a thorough irrigation in winter, if there is any lack of rainfall, or if it does not come in the proper time. Another irrigation is given in April or May, generally in the latter month, so that the young fruit may receive no check in its growth. It is then found to develop its full size and the maximum amount of sugar. In the case of cherries, just as soon as the crop is gathered the water is again turned on to stimulate the tree and make it recover from the exhaustion of ripening its fruit and the shock of the rather rough handling it received in harvesting. The tree then perfects its buds and makes a good summer growth, which prepares it for a good crop the following season.

In almost all the soils of Santa Clara Valley the only irrigation is applied in winter, using the surplus waters of the streams. Furrows are plowed between the rows of trees both ways, leaving each tree standing in the center of an inclosed space. Water is turned into the furrows and openings made into these inclosures, which are filled, then closed again, and the water allowed to soak away, filling again if necessary or sufficient water is to be had. This six or eight or twelve inches of extra water is applied by flooding, which insures a complete moistening of the soil down to the permanent or ascending moisture. As soon as dry enough the surface is plowed and harrowed smooth, to prevent evaporation, and the moisture thus supplied carries on the growth during the whole season and develops the fruit in the highest degree. Peaches, prunes, apples, and pears treated in this way seem to reach the highest degree of development in size, sugar, color, and flavor, with excellent shipping qualities. The size can be somewhat increased by an irrigation just before the time of ripening, but at the expense of sugar, flavor, and good shipping quality, and this we do not call a perfect and symmetrical development of fruit. We have known prunes thus irrigated just before ripening to require four pounds of green fruit to make

one of dried, while others, grown without a particle of irrigation, were of equal size, and required only two and one half pounds, or even less, to make a pound of the dried product. At our request the record of two orchards was kept last year—one that of Mr. Volmer, near Los Gatos, and the other that of Mr. Flanders, in the south part of the section known as "The Willows," near San José. The result was a due proportion of large-sized prunes, and ratios of 2.13 and 2.16 between green and dried fruit. In neither of these cases was there any irrigation, and it does not seem that irrigation would have been a benefit. The present year even smaller ratios have been obtained, but rather at the expense of large sizes.

Last winter the rainfall was about normal as to amount, but instead of one or two heavy downpours, it came in gentle showers of from one fourth to one half an inch, with pleasant days between, and the consequence was that the proper connection was not made between the upper and lower moisture, and there has been a check to the perfect development of the fruit in many cases. Growers who were able to supply irrigation as soon as this deficient development was threatened secured fruit of better size and weight.

We may state it as a rule, then, in the Santa Clara Valley, that with a normal rainfall, coming so as to thoroughly soak the ground in late winter and spring, thorough cultivation will keep the land moist and in just the condition to produce the highest development of fruit, and by this we do not mean size alone, but the most harmonious and perfect combination of size, form, flavor, color, and sugar. In fruit for drying sugar is one of the largest elements of value. The highest development of fruit is not produced by heavy irrigation, but by keeping the soil in a moist condition. By winter irrigation any defects of rainfall in time or amount can be remedied, and thus a full development secured.

When irrigation in summer is desired it is here easily accomplished by means of wells and pumping engines, and in many cases the prunings of the orchard will furnish sufficient fuel for the purpose. After the experience of last season many wells have been sunk all over the valley, so that in time of need water can be had at a moment's notice. All understand that water is a necessity, and if it does not appear naturally it must be applied artificially.

Apricot trees which show a checked growth after harvest, will be greatly benefited by an irrigation as soon as the fruit is gathered, and stronger and better buds will be developed for the next season's crop.

It was the writer's good fortune to be present in the great fruit-shipping district of Placer County during the shipping season of 1892. We found there a soil of disintegrated granite, rich in mineral matter, but very porous and not well calculated to retain moisture. It would be our idea that without irrigation such a soil would not have moisture enough at ripening time. No matter how much rainfall might come, no matter how much winter irrigation was had, the porous character of the soil and the excellent drainage would permit it to retain only a given amount of water, and this not enough to bring on and ripen a good crop of fruit. The growers there have water in ditches always at their command. They can and do turn on the water every few days and keep their soil always moist, and from its nature it is impossible to get it overwet, so that with even this almost constant summer irrigation the ground is never surcharged with water, nor does the fruit become over-developed

in size or watery consistency. In that section it is water, ever and always during the growing season, that develops the size, color, and flavor of their fruit. We found no irrigation here by flooding. Little streams ran down along the rows of trees, and the open soil took up just what was needed. A question of fertilization may arise in consequence of this, but that, of course, it is not our province here to discuss.

We see, then, that water is indispensable everywhere. When soils can be kept moist by cultivation, it is all that nature can ask to permit her to do her best work. When cultivation cannot do the work, irrigation must step in and supply the want, and whenever the orchardist provides himself with facilities for furnishing water when needed, he places himself beyond the influence of the vicissitudes of dry seasons.

To try to do by irrigation what ought to be done by cultivation is a mistake that is being made by many where water is abundant. Sodden, water-soaked soil will produce sodden, water-soaked fruit, something not desired nor desirable to driers, canners, shippers, or consumers.

To keep the soil simply moist at all times, so that the soluble material required by the tree is constantly going into solution; water enough to keep the roots fresh and growing, and to provide a medium to circulate freely in all the tissues of the tree for the conveyance of organized material to every part, is the ideal condition. Keep it so, if possible, by cultivation. If not, then by irrigation just when it is needed to keep up this condition, be it in spring, summer, or winter.

In the arid regions irrigation is of course a necessity, but even then care must be had not to over-irrigate. Our ideas have been directed in these remarks to deciduous trees. The great citrus industry of California has been made possible by irrigation, and the subject as applied to this fruit should be separately considered.

Irrigation of the grape is practiced in many places. With the raisin and the table grape it is a success. Wine grapes should never be planted where irrigation is required. We think we see a disregard of this in the thousands of acres planted by the Natoma Vineyard Company in wine grapes, which are flooded with water. We were told by the manager that no attempt was made to make a fine wine. This vine crop goes into sweet wine and brandy. Only in the dry hills and mountain sides can the rich flavors of our clarets and sauternes be developed in a degree to compete with the vineyards of France.

Shall we irrigate to develop fruit? Yes, with prudence, with judgment, with liberal cultivation, and whenever circumstances demand it.

Recess.



## XIX.

## EVENING SESSION.

President COOPER in the chair.

## FRUIT GROWING IN THE SANTA MARIA VALLEY.

By O. W. MAULSBY, of Santa Maria.

John Charles Fremont stands charged with having retarded fruit culture in the Santa Maria Valley almost fifty years, when, on his memorable march down the coast, he camped for a time at the head of our valley with an Englishman named Foxen, who had married a Spanish wife and had at that time a fine peach orchard in full bearing.

Being well acquainted with the topographical features of that section, Fremont compelled Mr. Foxen to pilot him over the Santa Ynez Mountains, thus avoiding the death-trap set for him in the Gaviota Pass. As a fitting punishment for the crime, the Mexicans cut down all of Mr. Foxen's peach trees, and for a quarter of a century thereafter our valley was nothing more than a vast plain, rainless throughout many months each year; brown, parched and dreary, practically devoid of perennial vegetation; in some places barren stretches of sand were raised in clouds by the wind, and the unfortunate traveler passing that way was glad to reach the sheltering hills, and his after reflections about the place contained no thought of horticulture.

The first settlers of our valley were stockmen and grain growers, and, as a matter of comfort, planted groves of eucalyptus trees about their premises. These trees grew remarkably well, and so encouraged the settlers that an age of gum-tree planting ensued. Nearly every farmer in the valley planted a row or two along the outside lines of his claim, and on many places groves of from five to ten acres were planted. A few years transformed this uninviting plain into a valley most beautiful to behold. All the avenues are on section lines crossing at right angles, and marked on either side by long lines of tall trees affording shade and shelter, and lending enchanting beauty to the scene. The annual rainfall has materially increased, and the quick, retentive soil produces a remarkable growth of vegetation.

Fruit culture for profit began in our valley about eight years ago, since which time tree planting has continued on an increasing scale, until now every owner of land in the eastern half of our valley either has, or is preparing to have, an orchard of from ten to one thousand acres. A number of experimental orchards were planted several years prior to this time, and these, to a great extent, have served as a guide to subsequent plantings. By these early orchards it was learned that apples did remarkably well, and a number of orchards are now in profitable bearing. Pears also do exceedingly well, and have been largely planted; they mature very late, and always find a good market.

While many varieties of plums have proved failures with us, there are a few varieties which do exceedingly well. The French prune seems well adapted to our local conditions, and is one of our leading fruits; it is a thrifty grower, producing heavy annual crops. This prune has been planted in our valley to the extent of fifty thousand trees.

The apricot, however, takes the lead in numbers and in profitableness.

It outgrows, outbears, and outnumbered any other tree in our valley. It comes into profitable bearing first of all. The fruit is large, abundant, and cures to perfection in our climate without the aid of artificial heat. It outnumbers our prunes to date just ten thousand trees, and the returns from these this year are of far more local importance than the historic "Return of the Ten Thousand."

Third in numerical importance is the improved soft-shell English walnut. Bearing trees of this variety in various parts of the valley prove its adaptability and profitableness, and cause walnut enthusiasts to claim for it a future position at the head of the list, and it has it now with regard to acreage; we already have over one thousand acres devoted to this tree, and it will be extensively planted this winter.

The peach, although it grows and produces well, has never gained that prominence with us which it really deserves, not through any failure of the tree to grow and produce an abundance of fine fruit, but wholly on account of local conditions regarding curing and marketing the fruit. Inadequate transportation facilities precluded any attempt at shipping fresh peaches, and there was practically no local market. The sun cannot be relied upon for curing peaches in our valley, on account of the foggy spells liable to occur at any time during peach season. With the advent of the cannery the past year came driers and evaporators, which greatly increased the demand for this fruit, and the acreage devoted to peaches will probably be doubled the coming planting season.

It is not just anywhere that the almond grows to perfection, but there is a section of country along the south side of our valley where the growing, producing, maturing, and shucking reach so nearly perfection that it would be difficult indeed for the most exacting almond advocate to find cause for complaint. I brought with me several samples of almonds from this section, which are now on exhibition. The top soil where these almonds grew is a fine sand mixed with a not very liberal amount of vegetable matter. The subsoil, which is from two to eight feet from the surface, is a silica formation, rich in phosphates, approaching the consistency of so-called "hardpan" when exposed to sun and atmosphere, but when moist it is as penetrable as granulated sugar. There is considerable almond enthusiasm among the people in this special section, and quite an acreage has been planted.

Cherry culture was originally considered a failure with us, but with the introduction of new varieties it has received a fresh impetus with already a successful showing. The writer has Royal Ann and Centennial cherry trees six and seven years old that have produced their second crop of large, well-formed, and luscious fruit.

As to citrus fruits, we lay no claim to them, nor have we ever made any attempt at growing them in a commercial way, although there is scarcely a dooryard in the valley without its orange and lemon trees with as fine specimens of fruit as ever grew, and in all stages of maturity, but aside from the adjacent cañons and hillsides, we have not the necessary heat for properly maturing these fruits.

Statistics concerning orcharding in California have received so much attention that great accuracy characterizes almost every statement, with probably but one exception. The item of incidental expenses connected with the care and cultivation of an orchard before it comes into bearing has seldom if ever been overestimated. For proof of this, inquire of

any one who has planted an orchard and brought it into bearing. In this particular, however, we are probably more favored in our valley than in almost any other section. Aside from our soil being a sandy loam and exceptionally easy to handle, annual crops of beans are raised between the rows the first three or four years, which help to pay running expenses, and some of the leading orchards of our valley did not cost the owners anything from the time they were planted until they came into bearing. Instances are on record where orchards were cared for under contract at good round figures, and the beans raised in the orchard paid all bills for the year and left a small deposit to the credit of the orchard.

Had it not been for this cheap producing feature there would have been but little to encourage fruit culture with us in the past. We had practically no home market. We had \$8 per ton freight to land our dried fruit in San Francisco, where, if we fail to accompany each shipment in person, the returns are invariably third or fourth grade on what is otherwise strictly first class. Samples of our processed fruits have been sent East, and pronounced equal to the best that has ever reached those fastidious markets, and yet in San Francisco they don't go unless we go with them.

Ever-changing conditions have kept us hopeful, and the future looks bright. The successful operation of our new cannery and a number of evaporators the past season have created a home market, which is quite stimulating. The assurance of the completion of the coast route of the Southern Pacific gives us a direct route to Eastern markets. Another very important adjunct of horticulture is just now being agitated by our fruit growers, and is seconded by nearly ever rancher in the valley, and that is irrigation. While it is demonstrated that profitable crops can be and are produced without the aid of water artificially applied, yet the fact remains that better, surer, and much more abundant crops can be produced with it, and since nature has provided us with a soil and climate admirably adapted to irrigation and an available water supply, practically inexhaustible and of easy access, we propose to make use of these advantages. This will also solve for us another important question which is claiming the attention of our people, and especially those interested in fruit culture, and that is better roads. Our sandy soil packs hard and smooth during the rainy season, making our highways the pride of the valley and the delight of all who travel them, and with an unlimited supply of water at command we can readily see how we can have the best of roads all the year round.

We have prepared a small exhibit of fruits for the World's Fair, consisting of fresh fruits, preserved in glass, and sun-dried, kiln-dried, and steam-evaporated fruits, prepared the same as that put up for the San Francisco market, the returns from which were for third grade fruit, and the accompanying excuse was that the fruit had been over-graded, under-dried, and too well packed.

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#### COMMITTEE GRANTED FURTHER TIME.

On motion of LEONARD COATES, the committee heretofore appointed to present a report on the paper of W. H. Mills, read before the State Board of Trade, was given further time in which to prepare the report, with instructions to present it to the chairman of this convention.



## COMMITTEE ON LEGISLATION.

The President appointed the following Committee on Legislation: Gen. N. P. Chipman, Frank Buck, W. H. Aiken, Fred. Cox, and B. F. Walton.

## COMMITTEE ON FORESTRY.

The following were appointed a Committee on Forestry by the President: S. J. Stabler, Abbot Kinney, and Frank A. Kimball.

## REPORT OF COMMITTEE ON LEGISLATION.

JUDGE AIKEN, as Chairman of the Committee on Legislation, presented the following, which was, on motion, adopted:

SAN JOSÉ, November 18, 1892.

*To the Fruit Growers' Convention:*

The Committee on Legislation has the honor to report upon the memorial to establish a Bureau of Statistics, as follows:

In view of the importance of the questions raised by the memorial and its novelty, it is deemed best that the subject have more thought and discussion than has been possible at this meeting, and the committee therefore recommends that the memorial be referred to the President of the State Board of Horticulture, with the request that he assign it as a topic for discussion at the next convention of fruit growers at Los Angeles.

W. H. AIKEN,  
Chairman of Committee on Legislation.

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FERTILIZERS AND THEIR USE.

H. A. BRAINARD: A few years ago I began to agitate the question of fertilization here to some extent, and to tell the growers, both personally and through the publication of which I have the honor to be editor, that their lands here were becoming exhausted, that the great amount of wheat which had formerly been raised upon them had exhausted certain elements, and that in raising fruit, particularly those kinds which they sent away to market—pits and all—they were depriving their land of a great deal of phosphate, which seems to be necessary to the production of any crop. I come from the State of New York, where no one would pretend to grow a crop of wheat, or in fact hardly any grain or garden stuff, unless he would fertilize the land with superphosphates. I see nothing of the kind here. The fragrant smell of the material, with which I was so familiar, I miss entirely in California, and I had been here several years before I found that such a thing was ever used here at all. I induced, finally, some man to try it. One gentleman, Mr. Vestal, said he would try it, and he did so upon his cherry trees, which were not coming up to the mark, although he had plenty of water for irrigation. I told him I would put on about 500 pounds of phosphates to the acre and see what they would do. He did it, and was so well pleased that the next year, without saying anything further to me, he put on from 1,000 to 1,500 pounds to the acre and worked it into the soil, spreading it all over the ground. He told me the following year that it had such an effect on the trees that he didn't think they needed any irrigation at all the next year, so he never unscrewed the top of his artesian well at all. He noticed a great improvement in the foliage of the tree and its

general appearance, and if I remember correctly, the product of the cherries was increased from about \$150 an acre to over \$400. I believe in one or two instances out at "The Willows," that phosphates have been employed on orchards. I believe I can tell, upon riding along or going into an orchard, simply by looking at the leaves of the trees, when this fertilizer has been applied. I am sure that in those orchards in "The Willows," where the owners have applied it that the yield has been very large and enough more money made from those orchards to pay for the use of the fertilizer two or three times over. Those who have used it can tell of its beneficial effects.

MR. ADAMS: In the Santa Cruz Mountains, where I am trying to raise fruit, we have a very mountainous country and a very uneven soil, and a good many places near the richest soil there may be some adobe—some alluvial mold, and the next acre will be all shale rock. Sometimes we are able to go around these poor pieces and not bother with them, and at other times we are obliged, for decency's sake, to take them in with the rest, and the question is whether where those spots come with thin soil over shale rock, say the soil is six or eight inches deep, whether it can be made commercially profitable by the use of phosphates or nitrates to raise trees of any size. We raise trees, but it takes them a long time to bear something, and when they are right in the midst of our rich benches, it does not look well—they look spotted, and I would like to know whether it can be made commercially profitable.

MR. SCHULTE: I have had a little experience with fertilizers, particularly with the nitrate of soda. A few years ago I found that my cherry trees were beginning to fade. Some of the limbs were dying off, and they were not growing as well as they should, and consequently a good many of the leaves began to get yellow and the fruit small. I came to the conclusion that there was something wrong and something ought to be done, so I began to experiment with fertilizers. I took a few rows and manured them thoroughly; then I took a few rows and applied superphosphates, and I took some more and applied nitrate of soda. I found out that nitrate of soda did the best work. The trees began to grow more vigorously than ever before; the fruit was larger and the trees looked to be decidedly improved in every sense of the word. I think I was best paid for my investments in the nitrate of soda. The land was good creek bottom—Coyote Creek bottom.

PROFESSOR HUSMANN: In using fertilizers, the original cost is a very important question. I was unfortunately put in a position, when I first came to this State, of taking the management of a very large place in very much spotted ground. We used stable manure, of course, all we could on the ranch, and then looked around for all other fertilizers, and experimented some, and the best and the cheapest fertilizer we found there was the ammoniacal liquid from the gas works, which we could get at Napa for simply the cost of filling some old casks that we hauled there. The manager of the gas works was always ready to have them filled gratis, only we had to pay for the labor of filling them. The way we used it was to mix it in a can with seven gallons of water to a gallon of ammoniacal liquid, and applied it in the hot summer in liquid form. We used to put the cask on the wagon, attach a hose to it, and then apply the liquid to the vines. We found that it would have a wonderful effect, and as one gallon of the fluid will make eight gallons of the liquid manure, it goes very far along. Another fertilizer, which we also

got from the gas works in large quantities, is gas lime, but that must be used very cautiously and scattered very finely over the ground and not too close to the vines or the trees, or else your foliage will become scorched and it will injure the tree. We used that also to a great extent, and we found it of very great benefit in loosening adobe soil, of which we had a good deal there.

MR. BRAINARD: One little point that I meant to have spoken about, which I didn't—it is a point that I am requesting the fruit growers to make some experiments on in the Santa Clara Valley. In some places the Moorpark apricot has the very bad habit of casting off its fruit in the spring. The fruit buds will start out pretty well, and oftentimes before they blossom will all drop off. From certain observations that I have made in one orchard I believe it is owing to a lack of proper nourishment. There is some element that is lacking, and I have seen experiments enough to partially convince me that it is a lack of phosphate in the soil that produces this imperfect formation of the bud; that they don't seem to have a strong constitution, and I would like to have the fruit growers throughout the State, not only here but everywhere, experiment in a small way. Place two or three or a half dozen trees, or half an acre, and use some phosphates, five or ten pounds to the tree, for a couple of years or so, and see whether or not it does not have the effect of strengthening the constitution of the buds on the apricot tree, which are so prone to drop off. The matter is now only in embryo, you might say; it is not certain that it is true, and yet I have such faith in it that I nearly believe it on account of a few experiments which have pointed in that direction.

QUESTION: What kind of phosphates did you use?

MR. BRAINARD: I could not state any particular kind. I do not remember the brand, or anything of the sort, which is used. Its value depends very largely upon the amount of phosphoric acid and nitrogen in it; we need both elements here. The experiments of Professor Hildgard show those are needed. In California most soils have plenty of potash, but look out that your commercial fertilizer has plenty of phosphate of lime and plenty of nitrogen in it. By "plenty" means anywhere from 10 to 12 or 13 or 14 per cent; that is about the average of the general commercial phosphates; I cannot name any brand.

J. P. DUDLEY, of San José: I have had a good deal of experience with cutting up vine prunings and plowing them into the ground, and I believe that is as good a fertilizer as could be wished for. I have a horse-power thrashing cylinder with knives through it, and the prunings are shoved in and then distributed over the ground. I believe I produce larger and better grapes and more of them, and the foliage remains green very much longer than they do without the application. Mr. Levy, in his "Organic Chemistry," says that in the old country they find it is very essential to manure their vines. A gentleman depending upon small acreage, where his vines are quite old, not knowing where he could get a fertilizer, saw that the grass grew better under the vines where the cuttings had been plowed under, and the next year a very great improvement in his vineyard was noticed. It seems that in that locality the fertilizer was so very essential that his neighbors noticed particularly that the gentleman's vines were very much improved, and they could not imagine where he got his fertilizer. He simply cut his vines with his shears and plowed them under. Now, I believe the prunings from



other trees might improve the ground, as it is something that all trees require, and when these prunings are burned up and the ashes left where they are burned, they get but little benefit. I believe the grand remedy in those cuttings is the phosphate, and I see a very great improvement even in applying the potash without the phosphates. I have used phosphates by grinding up bones. I now have tons of unground bones on my place, but I will grind them up at some future time. I have tried also making superphosphates by getting ashes, and I would almost as soon have the ground bone as to make a superphosphate, so far as I could discern.

MR. BLOCK: My advice to the fruit grower would be to fertilize with all vegetable and animal matter that you possibly can—any stable manure that you have; try and keep it damp; if possible, keep the sun off of it. Don't throw out the manure and allow it to dry so that it will evaporate until there is nothing left of any value in it. In the summer rather keep it wet, and if need be put some road dust or any other substance of that kind on and keep it wet; that is what I generally do. Do not make it so wet that it will run away, but keep it wet. I prepare, during the summer, probably three or four thousand loads of manure in that way, and if I have any weeds I pick them and put them in with the other and cover it with road dust or loam or anything else, saving everything that I can, and wetting it, and when fall comes around I have got it ready and haul it out and use it. I will say in this connection that my land is amply rich in nitrogen and I do not need to buy any. If you need any of that you can probably use what they call Chile saltpetre (nitrate of soda), that you can buy at a reasonable rate. Do not use too much of it, because it leaches away into the ground—each rain will leach it away.

QUESTION: How much is too much?

MR. BLOCK: That is hard to say; it depends how your land is. If you have very light soil it leaches away very easily. I should think about from two to five pounds to the tree. Of potash, I think we have enough. Of course, we have different soils in different sections. I have been for several years buying superphosphates and applying them. I have used from 800 to 1,000 pounds per acre, and it has paid me well to do it. If you happen to have a dry season following after the application of it, you may not see the benefit of it that year, but I venture to say if you follow it from year to year, go right along and continue putting it on, it will pay you for your labor. I irrigate, and consequently I put it on in the spring; those that can irrigate I should advise to put it on now, or as near this time as you possibly can before the rains come. The rains will take it down; it will not be washed out, but will stay there.

QUESTION: Do you put phosphates on the same ground each year?

MR. BLOCK: I have done it; yes, sir. The phosphate is the main ingredient to make the seed of our fruit. If the seed is blighted you will have no fruit; it is the greatest tax upon your soil. In some instances probably potash would be necessary. I am simply telling you what I find most advantageous for myself. I utilize all the manure that I can get, and that gives me some nitrogen and some phosphate. You must bear in mind that I have an orchard that has been producing for thirty-five years, and the previous owner has told me, with a good deal of pride, that he double-cropped his orchard and never put any-

thing on. Well, I have reversed it; I stopped the double-cropping of the orchard and kept feeding it, and I have had no occasion to regret it.

JUDGE AIKEN: I would like to ask how many trees to the acre you are enabled to support?

Mr. BLOCK: I don't know. I sometimes have been asked how many trees I have. If it is any one out of the State, I tell him I don't know, but perhaps some people that have seen it might believe me. I have all the way from 160 to 680 to the acre.

Mr. MILES: You speak about using nitrate of soda. When do you apply that to the ground?

Mr. BLOCK: That is hard to tell. I would rather put it on about the time it quits raining; that is the time I would advise. You have to take some little chances and get it as near as you can.

QUESTION: If the ground is irrigated, what time would you use it?

Mr. BLOCK: I would put it on probably in April, or as near blooming time as possible. Of course, if you depend on rain altogether, you will have to put it there ahead of the rain, so it will be taken down. If you find we are going to have rain lasting for any length of time, I advise you to delay it; but I can't see how you can tell that.

Mr. SCHULTE: In applying the nitrate of soda, I applied mine before the last rains in the spring—some time in March for the first application, and for the second application I simply put a certain amount of nitrate of soda into the water which I applied to the tree in irrigating, so as to get it directly and immediately to the roots of the tree, and I was astonished at the result or effect of this nitrate of soda upon the tree. In places where the trees have actually failed to grow and seemed ready to die, they threw out new and vigorous shoots, and I am satisfied that nothing ever paid me better than the application of nitrate of soda. That has been the case with my orchard; it might be different in others. I wish to state another instance of the application of oak chips. A man had a big pile of oak chips, and his orchard had showed signs of failing. He went to work and hauled those oak chips and spread them around his trees and plowed them under, hoping to see the results a few years thereafter. Of course, he applied quite a quantity. The immediate results, however, were a surprise to him. I think that a great many fruit growers are making a serious mistake in burning their pits, and not taking proper care of them. I think that the nearer we can come to supplying the tree with what it takes out of the soil, the better results we can obtain. I know one man who threw a great quantity of pits around his trees, and I noticed good results in that case. I think the pits are very expensive fuel, when we consider their usefulness as fertilizers.

JUDGE AIKEN: Following the example of our Eastern farmers in enriching the soil by planting clover and grasses and turning them under, I have for more than fifteen years plowed under in the spring two crops of clover and grasses something like a foot high and very thick upon the ground, and I have found this an excellent fertilizer. On land cultivated and enriched in this way, I have raised this year probably the largest amount of prunes per tree in this portion of the State, as far as I know, ranging from 400 to 800 pounds per tree. I find this a very cheap method of fertilizing where the clover and the grasses naturally grow. I know that my neighbors don't wholly agree with me; at least they have not got the clover and the grass to turn under, but they have a system of plowing in winter or very early before anything can make a



growth that can be called green grass or clover, and therefore they have nothing of that kind to warm up and, as it were, pulverize the soil. I find that my soil, after years of cultivation in that way, becomes a very soft, dark, sandy mold, and enables me to plow it almost any time in the year. I believe I could plow that land as late as June for the first time. I know it is said by some that the growth of the clover and grass takes substance from the soil, but I believe that by turning it under and allowing it to rot and decay, whatever it takes it returns there. After plowing I use what I call an Acme harrow, which does not draw out the grasses turned under, and I believe if our orchards could be handled in that way it would be found to be a very cheap and excellent fertilizer.

MR. BLOCK: I agree with the remarks made by my friend Aiken, and I would here make a suggestion that may be of benefit to a great many who cannot plant clover, for it will take a long time to get it started. I have used marsh-mallow to a great extent, and it has done a great deal of good, provided you can get it just at the right time to turn under. If you get warm weather and rain you can't always cut it down right, but if you can get it pretty thick over your land—I am not afraid of having weeds; I like to see them grow, providing I can get them about a foot high and get them under—it strikes me that this is one of the best things. Clover is hard to start, and you can't always get a good crop and get it in in good time, so that you can turn it under at the right time; but at this season of the year, if a person keeps the ground mellow, and plows—I can plow at this season of the year, and generally try to plow dry—now, if you were to seed with mustard—it is a quick grower, and would not cost much—I wouldn't be surprised but what mustard would make a splendid fertilizer for green manuring, when turned under. In connection with what the gentleman remarked about the nitrate of soda, I will say that I have had a grass plot or piece of land that has been used for a long time, and had a very poor crop of grass, and last spring I sowed some nitrate of soda over it and was surprised at the result. Where it had been turning yellow it got a splendid color, and I will venture to say that the crop of hay was increased 300 per cent, and if I hadn't put it there I don't think I would have had a quarter of a crop.

MR. ADAMS: We used to use dogweed in the East a good deal for that purpose.

MR. BLOCK: I am not familiar with dogweed, and couldn't tell. The reason that I suggested mustard is that it is a rank grower and grows at a low temperature.

JUDGE AIKEN: The clover that I speak of is the natural growth of the country—the alfifaree, as it is called. This is in the Santa Cruz Mountains, about fifteen miles from here.

MR. GRAY: I heard Judge Aiken tell that story once before, and two years ago I tried it, and I don't want to try it again in the same way I did; it was the year we had so much rain. About the time the grass was grown and the wild oats were about eight inches high, I commenced to plow, and before I had plowed very much, it commenced to rain, and kept on raining, and finally when it stopped raining and the ground had dried off a little, I started to plow again, but couldn't make it go, and finally I had to stop and buy a new mowing machine. I had rather a small pair of horses, and the only way I could get through my fertilizer was by going on the jump to get on top of it. I fought weeds all summer, and I don't know as I ever got the best of them.



## THINNING FRUIT.

G. M. GRAY: The question is asked as to the time to thin fruit. I shall commence thinning fruit next week when I get home, and shall begin with the shears; that is the time to begin.

MR. MCWILLIAMS: I have already finished pruning my apricots; now I am pruning the peach, and I find that, in my experience, if you raise a crop of barley or wheat, if it is second class, you get something for it; but if you raise a crop of second-class fruit, it is perfectly worthless—you can't get anything for it. Some time ago I tried the experiment of weighing ten peaches that measured one and three quarters inches, and the result was that when I peeled and pitted them there was six ounces of offal. I also peeled and pitted four that weighed a pound, and the offal of the four was four ounces. When I come to sell the peach, those that measured an inch and three quarters will take double the time to manipulate that it did those which weighed four to the pound, and my experience is that it will bring you in debt about 10 per cent, while the peach that measures two inches and a quarter and weighs four to the pound will bring you about 20 per cent profit. Last year I thinned before the frost, and the frost came and thinned a second time, and then my peach trees broke down. Now if I have a tree that I wish to produce a hundred pounds, I leave four hundred peaches on that tree, but if I want small peaches, I gauge the tree accordingly. My advice in thinning fruit is thin on the outside. A peach tree acts like a spindle; if you thin it out here, one peach close to the base of the limb will weigh more than the one out here, but this one on the outside will break the tree down. Trim your peach trees so that they will bear close to the tree; then they will not break down and you can thin your fruit to suit yourself. I find the great objection to thinning peaches is that we want to leave too much on our trees, and my advice to the men who thin fruit is to thin a tree to suit them exactly, and be sure in pruning never to let one limb lie over another so as to shut the sun off, but cut it off so that the sun can get through it. If you pursue this course, and raise peaches that are valuable, you will make a success. My experience has been that my small peaches are a drug on my hands and I can't get anything for them. We had better raise fewer peaches and have them salable.

F. M. RIGHTER: In this part of the country our idea is to thin apricots, or any other kind of fruit, as soon as we can determine whether that fruit is thick enough. When it first presents itself, and you are in doubt about it and don't know whether it will remain there or not, leave it alone, but as soon as you can ascertain whether it is going to remain, then commence to thin. We have been prompted to do this because of the moth, which in some places affects the peach the same as the codlin moth affects the apple and pear. I at one time thinned by fruit all I thought necessary; that is, left about twice as many peaches as I thought ought to remain on the limb, intending ultimately to cut that limb off and only leave one in place of two; but the moth came along at that time and didn't leave two, nor any. That makes it a little doubtful. It is not always safe to say, "I will thin out just so," because there are modifying influences that come in. The vitality of the tree mainly goes to the formation of the pit, so that it is essential that it be thinned early, before much vitality has been drained from the tree to form the pit, and the earlier the better. There is a great variety of ideas about how close

peaches may grow together and do well. One gentleman wants to grow them close to the main limb. Now, I leave one wherever it looks very vigorous, for if you leave a peach on a limb that looks about ready to die, the peach will look that way from the beginning of its existence to the end; but where the limb looks very vigorous and very thrifty, I think the peach will be pretty much of the same nature.

MR. JOHNSTON: How are you going to determine whether the peach is going to stay there or not?

MR. RIGHTER: By the looks of it. This year a good many of us thinned early, and the frost came along and took most all the rest of them. The frost is a good thinner; where the limb has been exposed and the leaves are well away from it the frost is a better thinner than most anybody you can put to work at it. It seems the leaf in itself has a heat, which is thrown off and saves the fruit where there is plenty of foliage. This argues, to my mind, that it is a good idea to have plenty of foliage around. Some people hold that pruning shears are about the best thing you could use when you go to thin, and I have known some persons who scarcely used anything else this year. Whether that is sufficient, I am not prepared to say.

MR. SCHULTE: My men thinned the Salway peaches early this year, and afterwards the curl leaf struck the trees, and the result was there were not any peaches. If we had waited a little longer we might have saved quite a little labor, or the curl leaf might not have taken all.

R. C. KELLS, of Yuba City: In our section—the Sacramento Valley—we consider the time for thinning the peach is from the time it first forms and gets size enough so that we can determine the forming of the peach, up till the time the pit hardens. I had in my orchard a year or two ago some peach trees which I had sprayed early in the season with lime, sulphur, and salt, but the wash did not have its effect upon the tree in time to check the curl leaf. However, enough peaches remained upon the tree to mature and make a fair crop. The trees pushed out a few leaves, but did not make any fruit growth for the coming year. The following year I had a good crop of wood, but no fruit, and that was the result of the curl leaf. We do not practice thinning apricots enough so that I am able to give any advice on that subject. I do not think that pruning is a sufficient thinning with us; our trees grow too rank—they make too much growth; the more we cut them back the more wood they make and the less fruit they produce; we prune too much. We think that thinning necessarily follows with careful pruning. In our particular neighborhood I am considered a crank on thinning, and at first I adopted the rule that I would do the thinning largely by pruning, but I could not make it work. In 1890 I thought I was doing a good job of thinning, and the consequence was that I had to have teams and men hauling poles to prop up my trees for several days, and then the trees broke down. I had picked as much as my conscience would allow me, and thought I was doing good work. I had thinned, for instance, to from four to six inches, and when we came to pick the peaches we found a great many two and three together; it shows that we are liable to overlook some. This year I thought I would do still better thinning, and in driving through I could scarcely see any peaches, and began to think I had better have the men let up a little on that; however, I gritted my teeth and let the men go ahead, and I had the best crop of peaches this year I have ever grown. The

man that was with me said, "You are taking all of your peaches off." I said that that was true, but I had said the year before that I was going to have them thin enough this year; so I will say this, if any one gets excited and scared that their peaches are all going to be taken off in thinning the little fellows, they will probably have enough left.

MR. JOHNSTON: The time for thinning fruit seems to me to be a question of great importance. We on the Sacramento River raise a great many peaches, and our trees always have too many peaches on them until we thin them out, and sometimes we make a mistake and thin our peaches a little too early, and that time cannot be determined until the pit begins to harden. You cannot tell by the looks of the peach until that time whether it is going to mature or not. It is well to go to work and pull off three fourths of the peaches when they are small, and then when the pit begins to harden you can go over your trees a second time, and, as brother Kells says, pull off pretty near all you can see, and then you will have enough left, and have your fruit properly distributed over the tree; but if you thin out before that time, you are liable to have the peaches in bunches over the tree and not properly distributed; because I have raised peaches a good while, and I have watched the growth pretty closely, and I have not been able to determine what peaches are not going to drop until the time I speak of. Of course, there are plenty of peaches deteriorating that you can tell just as soon as the bloom is dropped that they will never mature, but there are plenty more that seem healthy and strong, and nothing to prevent them from making peaches, until about the time the pit begins to harden, when they stop growing. The peach that is going to mature grows right along, and grows very rapidly, and then you can make up your mind that the small peach is going to drop off and not mature; so that my practice is to thin my peaches twice. It is a little hard work sometimes to do it, and difficult enough to get up courage to go over an orchard twice, but I find that is a sure way of making a peach crop on the Sacramento River.

MRS. JONES: When I started in the fruit business, raising peaches, I inquired of my neighbors, and they told me to wait until about the time the pit hardens, and to leave the peaches about six inches apart, and see that they were evenly distributed over the tree. I followed that advice as nearly as possible, and I thought I had made a pretty good job, but for some unknown cause or other the peaches concluded to thin themselves after that, and they did so pretty thoroughly, but what were left on the trees were of excellent size and quality, and I think I made a reputation for my orchard that year, although I was pretty well discouraged at first to see the ground covered again with peaches that I had intended should stay on the limb.

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#### FUNGUS ON ALMOND TREES.

MR. GRAY: I saw in one of the papers last spring an account of a fungus working on the young almond. I have not been able to find out anything about it, and if Mr. Brainard is here and can tell us about it we would like to know.

MR. BRAINARD: I will state that several months ago, several journals described a fungus appearing upon the leaf of the almond. I had never



seen it, except in one instance, anywhere about here, but in an almond orchard in Butte County—I cannot just now remember the name of the owner—I found a well-defined case of it, and I brought the leaf home with me and compared it with the engraving showing the fungous disease. It makes the leaf of the almond look spotted. I placed it under a microscope of moderate power, and it was evident it was a case of fungus. We found only one tree with it. As to a remedy, one can treat all of these fungous diseases with some preparation of copper, either the Bordeaux mixture or a solution of copper and ammonia. We have plenty of formulas in most all of the papers or treatises on fungoid diseases. I keep them standing in the columns of my journal all the time, and I should treat that fungus, if I saw it in any of the orchards, in that way.

MR. COOPER: I will state, in reply to Mr. Gray, who made inquiry as to fungoid diseases on the almond, that upon examination of the opening address of the convention last year, he will see mention made of that; and any one wishing to have further information, by addressing the Government agent, Prof. Newton B. Pierce, stationed at Santa Ana, Orange County, can get the information regarding the fungus troubling the almond tree.

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### NEW USE FOR DRIED GRAPES.

By J. V. DUDLEY, of San José.

MR. PRESIDENT, LADIES AND GENTLEMEN: I commenced using the grape as a laxative a few years since, and found it all I could wish for. I used the Rose of Peru grown upon clay ground; it ripened late and was quite tart. The weather had become quite uncertain for drying, but through the kindness of Mr. Moulton they were put through his evaporator. I was at the time afflicted with muscular rheumatism, which, to my great pleasure, soon left me. I ate a handful of raisins at night, and found in the morning that my mouth was as moist and pleasant as at night, also a laryngeal trouble soon disappeared that had been with me for many years. The next year we had more put through the evaporator and distributed among our friends, and all reported pleasantly. I then turned to Leibig's Organic Chemistry, where he says the use of wine and fat, which are only so far altered in the organism that they combine with oxygen, has a marked influence on the formation of uric acid. The urine after fat food has been taken is turbid, and deposits minute crystals of uric acid. The same thing is observed after the use of wine, in which alkali necessary to retain the uric acid in solution is wanting, but never from the use of Rhenish wines, which contain so much tartar under the head of calculus. Uric acid calculus is formed in consequence of a deficiency of inspired oxygen or excess of carbon in the food. The medical reports state that upon the Rhine, where so much cream of tartar is consumed in wine, the only cases of calculus diseases are those which are imported from other districts.

I have made a very free use of the tart raisin for the last few years, and am glad to know that all who have used them for liver and kidney troubles are quite as well pleased with their effect as I am. One of our large fruit dealers asked me if I thought the tart raisin would help his rheumatism in his shoulders and his liver trouble. I replied, "Mr. Moulton has been using them for a couple of months; will you make

inquiries of him?" He made inquiries. Mr. Moulton replied, "I cannot tell what they will do for you, but I can tell you what they have done for me. They have cured me of catarrh, dyspepsia, and rheumatism. When I commenced using them I could not get my right hand back of my hip; now my shoulder is as limber as ever."

I have looked up scrofula in its various branches and am quite certain it may be removed from the system as readily as the rheumatic trouble, and prevent cancer and phthisis from putting in an appearance. Also, I believe that after the use of tartrate of potash we need have little fear of an inflammatory action in the system. Pneumonia will not be as prevalent as at present, nor need we have much fear of the bacilli of the Asiatic cholera finding lodgment in our system.

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### FIG CULTURE AND FIG PACKING.

By D. SHERMAN, of Newcastle.

We know of no variety now being packed worthy of culture save the White Adriatic, though we look for grand results whenever we are enabled to mature the fruit from the imported tree from Aiden, Smyrna.

We favor rooting the cuttings in the nursery, though with care we obtained as fine trees from cuttings set in orchard as from yearlings set at same time—the third year there was no noticeable difference. The tree should be cut back when first set, also the second and third years, in order to strengthen the main branches near the trunk, especially at the union with the stock.

We advocate forming all varieties of trees very low, six inches from the ground being none too low for the peach, while the fig we prefer twelve to eighteen inches. Ladders are a necessary nuisance, still we can manage to prune and harvest without them several years longer than we thought formerly, without sacrifice to quality or quantity of fruit and a gain in the vigor and ability of the tree.

It is to be remembered that we are writing from the interior, where shade is desirable.

Without applying the shears, the fig forms a symmetrical, beautiful tree, whose horizontal branches are apt to split at the stock with its heavy fruit and the additional weight of a careless picker.

We cannot obtain in our locality the desired growth of the tree and size of fruit without water. As to how often and the amount, we are as yet on experimental ground, although favoring application of water early in the season, to be continued not later than August 1st. After the last irrigation the ground should be thoroughly though not deeply cultivated. The gravest question for consideration, and one which may be more or less controlled by time and method of irrigating, is the fermentation of the fruit on the tree. We have this season been free from souring; the two preceding years we were considerably troubled, though not seriously. The trees being young, too late irrigating and climatic changes were the attributed causes. We believe a tree suffering for water late in the season, as well as one over-moist, is liable to ferment its fruit. Whether high, well-drained land, or rather low and not very well drained, the same rule appears to apply. This season we had a block on high land which fer-

mented some of its fruit for need of more late water, while the block adjoining, in lower, better watered land, had but few sour.

Late in the season there are immense quantities which cannot be dried successfully, owing to rains and moist, cool atmosphere. Should we be able to obtain a suitable drier, the time of harvesting and increase of crop would be great and worth striving for.

Previous to this season, we followed the advice of growers generally in hand-picking the fruit. Our ideal fig is one picked from the tree as soon as it is ready to drop by a jar or when it has ceased to derive any nourishment from the tree, the fig being in a shriveled state. In practice it is yet to be proved the best method. We have been gratified with this season's result, viz.: about one half gathered from tree, the other half picked from the ground. If all the fruit would drop of its own accord within a seasonable time, we would not pick a fig from the tree; but as many hang until they become worthless, it appears to be necessary to hand-pick them.

The fruit from the ground is rich in sugar and flavor, though inclined to toughness; this, however, is overcome by manipulation.

The fallen fruit may be put into baskets of any depth; not so that from the tree, as more care must be used, lest it be injured.

After spreading on trays, which can be done rapidly, we subject to a sulphur bath for a few minutes only. Too much sulphur destroys the richness and sweetness. From the sulphur-house the trays are to be taken to the hottest corner of the ranch, inclining them toward the south. Later in the season a concentration of the sun's rays applied to the fruit may be practical. After remaining in the sun from two to four hours, we turn them by placing an empty tray over the figs, having a man at each end, who quickly invert them. The pressing of the two trays together prevents the fruit from rolling. A second turning may be desirable, though we have not considered it essential.

When sufficiently dry, place in sweat-boxes, which should be carefully watched, lest some of the fruit may have been taken up too soon, ever bearing in mind that the less drying the better, provided they are in condition to keep.

After the sweating stage, they can be at once processed, or dipped in boiling water, to kill all insect germs, and stored for months if desirable. Covered boxes or bins may be used.

However, the sooner they can be placed on the market the better, so that they may start the trade before the new Asiatic crop arrives and supplies the holiday trade.

The processing and packing appear to be another industry apart from the growing, but quite within the province of the producer.

Take the figs from bins or boxes; dip into boiling, very thin syrup (made of water, a little white sugar, and glycerine), or in salt, boiling water. We are using the former solution. Our aim is not to match the Smyrna product, but to place on the market our fig in such package and under such treatment as the public prefer; hence, we await the verdict of the people. We sometimes before the syruping run the figs through rubber rollers, which helps in reducing the toughness, apparently thinning the skin. This makes it easier and quicker for the packers. While the figs are yet warm from the syrup, the thumbing and packing may begin. There should be three grades. The first is carefully packed in molds and pressed, remaining under pressure until the shape is fixed,



when they may be taken from the forms, wrapped in paraffine paper, and placed in cartoons, or as bricks of figs in boxes of ten or twenty pounds. A round tin box makes a neat and attractive package, so also does the cartoon. The second grade should be packed in larger boxes, say ten to twenty pounds each.

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#### THE NEXT CONVENTION.

Invitations were presented requesting the State Board of Horticulture to hold the next State Fruit Growers' Convention at Santa Rosa, Pomona, and Los Angeles.

On motion, Los Angeles was recommended.

There being no further business, the convention adjourned *sine die*.

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TRANSACTIONS

OF THE

SEVENTEENTH STATE FRUIT GROWERS' CONVENTION,

HELD AT

LOS ANGELES, NOVEMBER 21-24, 1893.

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XX.

## TRANSACTIONS

OF THE

### SEVENTEENTH STATE FRUIT GROWERS' CONVENTION,

HELD UNDER THE AUSPICES OF THE

STATE BOARD OF HORTICULTURE, AT LOS ANGELES,  
NOVEMBER 21 TO 24, 1893.

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CALLED TO ORDER.

The convention was called to order by Hon. ELLWOOD COOPER, President of the State Board of Horticulture, promptly at 10 o'clock A. M., Tuesday, November 21, 1893.

PRAYER.

Rev. A. T. PERKINS opened the convention with prayer.

VICE-PRESIDENTS—ASSISTANT SECRETARIES.

Hon. Abbot Kinney and Mr. G. J. Griffiths were chosen Vice-Presidents.

Rev. A. T. Perkins, of Alameda, and Mrs. Mattie S. Jones, of Yuba City, were chosen Assistant Secretaries.

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#### ADDRESS OF WELCOME.

By Hon. ABBOT KINNEY, of Lamanda Park.

LADIES AND GENTLEMEN, MEMBERS OF THE CONVENTION: Los Angeles greets you and welcomes you all heartily and respectfully as representatives of the great and growing interest of horticulture. We are glad to have you here for many reasons, not the least of which is the benefit we hope to derive from this meeting of progressive and public-spirited men. California has gloried in the reputation won by the horticulturist. It is he who has advertised our soil and climate, and sent the noble army of fruits as missionaries to tell the world of California. Great as this interest in horticulture has become, we expect to see it still greater. Already we have invaded European countries, and I think that nothing else should satisfy us than such a superiority of quality as will command the highest markets of the world. California contains within short distances wide ranges of adaptability to various fruits, by soil, altitude,

temperature, and humidity. From the sea coast to the mountains we find conditions favorable to every fruit of the temperate zone and of the semi-tropic regions, and some of the tropical fruits. We have hardly yet settled the limits and best product of our different fruits. It is by establishing the best productive conditions for our fruit that we can most readily attain that fineness and excellence of quality that will command the confidence and tribute of the world.

The relations of fruit growers with their laborers is a matter of importance to them, and concerns the community about as much. There has been a tendency amongst us to adopt the maxim, "that as the wage of the laborer is low, so is the cost of production low;" and another maxim, "that the finest grade of prepared fruits demands the lowest price to the individual and the laborer for their economic production." If these maxims be true, the interest of the employer and the laborer are irreconcilable. Under such principles, it will be to the interest of the employer to push down the individual wage to the barest means of subsistence, and still eternally to grind the laborer down. A little consideration would make the whole republic stand aghast at the prospects of our future, under the application of such principles. The principle, "that as the individual wage is low, the cost of the product is low," holds no hope for humanity. The industrial history of the world does not establish this principle, but tends rather to the contrary. While wages have been advancing, the cost of production has been diminishing. Let us then adopt a policy of coöperation; let us say "that the wage cost of product will correspond with the intelligent application of honest effort." Under such a principle, the interests of the employer and of the laborer may be united for the betterment of both. With this principle, the interest of the employers will be for the elevation of the laborer, rather than for the degradation. We will then connect cheapness with competency, and realize that the high-priced laborer, if intelligent and honest, will be the greatest producer. With this principle we can, with reason, ask our schools and universities to turn some of their energies to the preparation of our young people for intelligent work in our fruit industries. We can hold forth to them the hope of good pay for good service.

We welcome all of you. We welcome those of you whom we have known so long and esteem so highly. We welcome those who have come so far, and whose energies in behalf of the fruit industries never seem to tire. We regret that your convention does not sit in perpetuity, so that our welcome can be eternal.

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Vice-President KINNEY in the chair.

#### ANNUAL ADDRESS OF PRESIDENT ELLWOOD COOPER.

LADIES AND GENTLEMEN: This is the Seventeenth Fruit Growers' Convention, and the thirteenth held under the auspices of the State Board of Horticulture.

When we met one year ago at San José, the fruit growers generally were in their best mood, having disposed of most of the fruit produced at reasonably good prices, and were encouraged in the belief that through-

out the State this industry was in a prosperous condition. This year has not been one so satisfactory, owing to the financial disturbances that have existed in every part of our country. Much depression has been felt; many losses sustained, yet we ought to feel thankful that they were not greater. The fruit growers have probably suffered less than those engaged in other industries. Our misfortunes should teach us this lesson, not to be forgotten, to avoid like disasters under like circumstances. Our fruit losses have occurred from the timidity of money, and the depressed markets. This brings me, first, to the necessity of our having a Bureau of Fruit Statistics. At the San José Convention a memorial was presented asking that a Bureau of Statistics be created, by established laws, with ample compensation to insure its effectiveness. This memorial was referred to a committee, who reported as follows:

SAN JOSÉ, November 18, 1892.

*To the Fruit Growers' Convention:*

The Committee on Legislation has the honor to report upon the memorial to establish a Bureau of Statistics, as follows:

In view of the importance of the question raised by the memorial and its novelty, it is deemed best that the subject have more thought and discussion than has been possible at this meeting, and the committee therefore recommends that the memorial be referred to the President of the State Board of Horticulture, with the request that he assign it as a topic for discussion at the next Convention of Fruit Growers at Los Angeles.

W. H. AIKEN,  
Chairman of Committee on Legislation.

In this connection I refer you to my remarks before the San José Convention on the disposal of fruits.

Those who have kept pace with the events of the year must realize that something in the line of this memorial must be established. The discussions by the raisin growers, the prune growers, the orange growers will convince every thoughtful person that there must be unity amongst the producers, to avoid over-stocked markets and under-selling, also that the fruit growers must sell their own fruits. A Bureau of Statistics, with a competent statistician, could supply the necessary information to every branch of the fruit industry. With this information, the growers of like products could unite and determine how and where to sell their crops—haphazard shipments to a dull market will always be uncertain in the results. It is that we cease to make shipments with the risk of not getting proceeds sufficient to pay the railroad freights and expenses of drayage and commissions.

As a part or branch of this united fruit plan is the important question of fruit inspection. I refer you to my opening address at the National City Convention (Report of 1889, pages 329 and 330). I also refer you to the address of our Vice-President, in Report of 1891, pages 369 and 370.

*Forest Culture.*—I refer you to the address delivered at San José. I have nothing to add on this occasion.

*Olive Culture.*—At the session of the last Legislature an Act to regulate the sale of imitation olive oil was passed. This Act appears to cover every point. It is made the duty of the State Board of Horticulture and the State Analyst to enforce its provisions. Nothing, as yet, in the way of testing the requirements of said Act, has been brought before the courts. The State Board is now waiting the action of the State Analyst. The violation of some of the provisions is universal.



*Vagrant Laws.*—I refer you also to the San José address.

*World's Columbian Exposition.*—California has reason to be proud of the results of her efforts. She has shown to the world a part of her great resources, her capabilities. It will invite and secure for her an intelligent population, which will bring still greater prosperity to her people.

*Railroad Transportation.*—I beg to call your attention to the address delivered at San José.

#### IMPORTATION OF PARASITES.

In referring to this subject, and in order to bring the matter more intelligently before the great body of fruit growers, I will go back to the very beginning of the work of the State Board. It was organized on the 5th of April, 1881. Your attention is called to the first report, published in 1882. On pages 22 to 34, inclusive, will be found the essays of Felix Gillet. I had, at that time, been fighting insect pests by artificial means for about ten years; my experience with the black scale dated back about six years. At that time (that is, during the summer of 1881) it had not occurred to my mind that there was any other way (except by artificial means) to overcome the destructive ravages of the pests that were giving me so much trouble. I was impressed by the articles of Felix Gillet and the earnestness in his manner of presenting his views. He claimed that our modes and plans were all wrong; that we could not fight insect pests successfully except with their natural enemies. I quote a few lines from his essays:

"But to think that nothing short of an entomologist will make the insects go, and that the appointment by the State of such an officer would be the surest way of rescuing this land from the grip of that great pest, is, let me tell you, a mere delusion. See what has been going on in some parts of Europe for the last twenty-five years. What have they achieved there, with an army of the best scientists in the world, in fighting out these destructive pests that attacked their orchards and vineyards, and also in dealing against those maladies that devastated their cocooneries? Science, after proving a failure, left the field entirely to the practical men of the land—those who raised silkworms. At a time when there was no official entomologist they had their own way of fighting the destructive insects. To get rid of the common cabbage lice, which in certain years were becoming too thick around, they had the insect ladybug, which, both as a perfect insect or in a larva state, accomplishes an incredible consumption of plant lice. To go after the innumerable beetles, snails, spiders, worms, etc., that infested their gardens, and that bred thicker than was desirable, they had the toad, one of the most useful animals to be had in gardens, and which in some countries constitutes an article of commerce, being bought by gardeners to be let loose on their land; insectivorous birds were protected by law; animals like the land turtle, the hedgehog, and others were, with the toad, made regular members of the garden household, while an immense amount of insect hunting was done by hand. But this is an age of progress; all that has been changed, and in lieu of these primitive modes of fighting garden pests, we have entomologists, well versed in insect anatomy, and infernal drugs, from bi-sulphide of carbon to cyanide of potassium. Nothing is left to man but to imitate

nature, and getting hold of those insects that prey upon other insects, hurl them against the marauders that infest his land. Why, in fact, should not we raise predaceous insects to fight noxious insects? If we want to imitate nature, it is the best thing we could do. When we see what desolation and ruin are caused by insect pests nowadays in wheat, cotton, and other fields, in vineyards, orchards, and forests, I ask again, why shouldn't we take hold of such means as nature has placed within our reach in fighting them? Entomology may be regarded so far as nothing else but a 'negative' science, which is of very little help to us, for it is not so much the anatomy or Latin name of the noxious insect that we care for as its habits. To successfully fight all insect pests, the first thing we have to know is their habits, and all about their parasites."

With the foregoing quotation, I will leave Felix Gillet. As there were not many copies of the first report, it is important that some further record should appear in our horticultural literature to his credit, as being the first member to advocate this plan of overcoming the ravages of insect pests. Let it be ever to his credit. The wonder is that twelve years have elapsed with the loss of millions of money, and so little accomplished.

When we look back at the history of the struggles of the producers since the early settlement of America and learn of the various pests that have swept over the country devastating the farms and orchards in their march—whole neighborhoods having been reduced to want—the wonder is that something has not been done to prevent the return of like disasters.

We have seen intelligent nations in the past hundred years fitting out expeditions at great cost and expense in the pursuit of scientific knowledge in other directions—voyages to the north in search of the Polar Sea; expeditions to make observations in the total eclipse of the sun; expeditions to take observations of the transit of Venus, in order, if possible, to get the correct measure or distance from the earth to the sun, and thereby be able to measure everything else. In 1874 the United States Government sent out six parties, composed of a large number of scientists, with their assistants—three expeditions in the Northern Hemisphere, and three in the Southern—for the purpose as above mentioned. European governments did as much or more; no expense was spared in trying to obtain more accurate knowledge on this point. With this disposition to study and investigate, does it not occur to you as being most remarkable that intelligent races through so many generations have never sent out expeditions to search for parasites, the natural enemy of agricultural and horticultural pests?

Natural science or natural history takes first rank in the college curriculum, because it deals with, or takes cognizance of, the productions of nature, their relations to each other, and all the phenomena of life, both animal and vegetable; hence, this study is of paramount importance to the cultivation of the soil. No class in the great family of man occupies so important a position. If it is not prosperous and happy, certainly no other class can be. Accepting this statement as a fact, it therefore becomes the first duty of nations to prosecute an inquiry into the development of plant and insect life. It not only has an utilitarian purpose or object, but in no other way can the mind be brought into so close relationship with the thoughts of God and his creation.

The products of the soil are subject to greater mishaps than that flowing from any other line of business. It becomes our duty to assert ourselves and demand that a new policy be instituted, and that we have expeditions fitted out to every part of the world, investigating parasites and fungoids, so as to be prepared to meet the enemies that are now disturbing our crops, and any new enemy that may appear either to the farm or the orchard.

Life is too short for us to entertain any hope of obtaining such legislation in the United States Congress, so that we must rely upon ourselves. I therefore recommend the appointment of a committee to consider this question of establishing a permanent bureau to send out expeditions to search for predaceous insects, and to gather information generally concerning depredations either to farm or fruit products. Said committee could formulate a plan and present it to the next Fruit Growers' Convention, to be held in 1894, and, if ratified, to go before the Legislature of 1895.

There is no doubt in my mind but that some sort of a compromise could be effected—as between the State Board of Agriculture and the State Board of Horticulture as to an adequate amount to be appropriated for this special purpose without increasing very greatly the present outlay.

To return to the first publication of the State Board, I call your attention to my essay—title “Disease of the Olive,” Article No. 1—to be found on pages 35, 36, and 37, dated September, 1881. In that essay occurs this information, obtained from the best books I could find in Europe. I quote: “Bernard wrote on the subject in 1783 that there were no other writers before that time; that all the Roman authors of the first half of the eighteenth century were silent upon the subject. It was in 1783 that all the proprietors in some localities trimmed down their trees to mere trunks in order to clean them, and commence with new trees. It is certain that a malady so characteristic with such a disagreeable aspect could not have escaped the observation of authors. Abbe Couture presented a memoir to the Academy of Marseilles about the same time that Bernard wrote, in which he declared that the ‘Coccos Oleo’ was observed for the first time in 1781.”

Lejourdan and Captain Cousin place the insect a few years earlier.

It was at the first meeting, held April 5, 1881, that I took a branch of an orange tree completely covered with *Icerya purchasi*, called white scale. No member, either of the Viticultural Board or Horticultural Board, at that time had seen this insect. I had traced it satisfactorily to my mind from Australia. It probably alarmed me more than any other one thing during my life's experience. I had planted a large number of fruit trees, was fighting other pests, and feared this, the most disgusting of them all. In my examinations at that time in my neighbor's orchard, I made this discovery: that nowhere could the white scale be found on the olive. Trees of the olive lapping into and adjacent to other trees badly infected were free, so that I felt more easy, still I never relaxed my efforts and determination to keep my ranch free from it. I cut down, as a precaution, all the acacia trees. When I found the scale on an orange or lemon tree, I at once had loads of straw hauled, spread over the ground under the infected trees, and put on fire during the hot part of the day. The trees were removed from the orchard without delay.



The articles as above quoted from the essay of Felix Gillet had made a deep impression on my mind. In my communication with my neighbor, Mr. Sherman P. Stow, he said to me that he had seen in an Australian paper, or quoted from one, this statement: "That the white scale might prove very troublesome to the California citrus groves, unless the parasite was imported with it." This circumstance, with others, determined my investigation of the subject. I wrote to the United States Consul at Melbourne, Thomas Adamson, Jr., who was a Philadelphian. We knew each other through a mutual friend. I corresponded with Baron Ferd Von Mueller and others on the subject. In 1883 Amos R. Little, a Quaker gentleman of Germantown, Pennsylvania, a Director of the Pennsylvania Railroad, who was on his way to make a voyage around the world, visited my place with his wife, and while staying with me offered to do anything in his voyaging that was possible to assist us. I took him in my buggy through the infested orchards, so that he could familiarize himself with these insects. I also gave him the plates, so that he could not be mistaken in the search. While traveling in Australia he reported that he could not find any such insect, nor could he learn anything about its ravages from the people to whom he had letters of introduction. This satisfied my mind that there was a parasite keeping it in check.

The writings of Abbe Couture and Bernard I accepted as facts as to the black scale. Olive oil had been made in western Asia and southern Europe probably for more than two thousand years, and as to the cause of the appearance of said insect in 1783, I commenced an examination. I had traveled through various portions of California during the spring and summer of 1868, and was impressed with the universal remark of the owners of fruit gardens, "That in California we have no insects." The peculiarity of Australian vegetation, which at that time was so interesting, made it desirable to have plants from that country in every household garden. Here was the nucleus to the whole pest question. As to how the black scale could have reached Europe on or before 1783, I traced it through, and it is possible and more than probable that it was brought over in one or the other of the voyages made by Captain Cook.

In a narrative written by himself (see Chambers, 3d vol., page 215, or in a more recent compilation edited by Chas. R. Lowe), Captain Cook sailed on his first voyage July 30, 1768; returned 19th of April, 1770, or thirteen years before the time mentioned as above. Sailed on the second voyage 13th of July, 1772; sailed on the third voyage, 14th of July, 1776. He had with him on the first voyage Sir Joseph Banks, President of the Royal Society, and Dr. Solander, a learned Swede, who was an adept in natural history.

On page 19 of Lowe's compilation, we find this statement: "Dr. Solander and Mr. Banks went on shore, and returned about nine in the evening with upwards of a hundred different plants and flowers hitherto unknown to European botanists." On page 23, the following: "On the 20th, Mr. Banks and Dr. Solander again proceeded on shore and collected a number of shells and plants hitherto unknown." On page 76, the following: "About four hundred species of plant life were found, all of which are unknown in England, except garden night shade, sow thistle, two or three kinds of ferns, and one or two sorts of grass." On page 86, the following: "The name of Botany Bay was given to this

place, from the great number of plants collected by Messrs. Banks and Solander." On pages 102 and 103, the following: "While busy in this survey, Mr. Banks was attentive to his favorite pursuit, and collected many plants he had not before seen." We find on their return home further reference as to collecting plants. (See page 119.)

We have abundant evidence of the large collection of plants, especially in Australia and New Zealand. Through these collections was transported to Europe the black scale, and perhaps other scales. The frequent communication by steamer from Australia to San Francisco and the great desire on the part of Californians to procure plants from that country was an easy and sure mode of introducing insect pests here. It is a matter easily to be determined that nearly all our pests were known in Australia before they were noticed here, and there is no doubt in my mind but that they were brought from Australia to California. When Fred C. Smith, of Australia, who was traveling in this State the past summer, to gain information in the cultivation of fruits, was on my place, he remarked that the black scale was known to him from his earliest childhood, but in passing through my orchards he remarked that he had never seen a black olive tree; that the olive trees were bright and generally loaded with fruits, much better than any of the trees I pointed out as having a good crop. I call your attention to the report on the "Importation of Predaceous Insects," made to the State Board of Horticulture by Albert Koebele, in 1891, page 15, *Aspidiotus aurantii*, "Red Scale." He says that this is the most numerous coccid upon citrus trees throughout Australia. "The Hon. Robert E. Scobie, of West Maitland, New South Wales, who is well acquainted with all insects affecting fruit trees, informed me positively that this same insect was very numerous fifty years ago upon his trees." That would carry us back in California to 1842. "Australia is in possession of more than enough natural enemies to keep the red scale (coccid) in check with ease." On page 16: "In another instance an orchard of some eight or ten acres, and about thirty-five years old, the proprietor of which always supplied sufficient manure, and kept the ground cultivated during the whole of its existence, had been infested with red scale as well as other scales, and yet but a very few trees along the border of one side could be found that showed any traces of them. The whole orchard within the thirty-five years had never been pruned, sprayed, or even washed, and yet I never met with in Australia a finer lot of trees, such glossy, deep green foliage, abundance of fruit, and so free from scales at the same time."

One more quotation and I will leave Koebele's report. See page 13, under head of Australia: "If once thoroughly known, the number of coccids and their enemies in Australia will be something astonishing, and it will be found that this country is the original home of many species that have spread over the greater part of the globe." This is the conclusion of a searcher and one who has made careful observations in the fruit orchards of that country. My conclusions on this point, which appeared in print several years before Mr. Koebele's first voyage, were formed from an entirely different source. From the study of history, no other country offers so much, or has such a wide field for this investigation.

Mr. Albert Koebele has been engaged by the Hawaiian Government to search for parasites to destroy the noxious insects so numerous in the

Sandwich Islands. He will leave in the proper season for Australia. I will make an arrangement with him in his searches to employ a competent assistant, so as to secure for us such other predaceous insects that might be advantageous in our fruit orchards. I am proud to say that the first money proffered to meet such purpose was by fruit growers of the San Gabriel Valley.

Prof. M. Rouzand, of France, has written a pamphlet giving the life history of a moth or butterfly, the *Erastria scitula*, a formidable enemy of the black scale on the olive. This book and the correspondence come through Mr. Arthur P. Hayne, who is engaged at the University of California at Berkeley. Mr. Koebele has written the directions how to get this moth to California, and we expect to receive the same through Mr. Hayne the coming winter. The translation from Professor Rouzand concerning this valuable parasite will appear in our next report. By this statement I do not wish it to be understood that there is any doubt as to the efficiency of the parasites that are already at work on the black scale; on the contrary, I wish to assert in this place that the *Rhizobius ventralis* and other predaceous insects now at work, will as effectually destroy the black scale as the *Vedalia* did the white; possibly it may take a little longer, as there are more than one hundred times as many black scales as ever there were of white, also it is more difficult of attack, as it is a harder substance. Right here let me say to you that so far as the black scale, the red and yellow scales, and the San José scale are concerned, the days of their ravages are numbered, but, acting on the advice of Mr. Koebele, we want to get numerous predaceous insects to prey upon all the scales that disturb our fruits.

I beg to call your attention to a pamphlet published by the State Board of Agriculture of Massachusetts, dated January 10, 1893. This pamphlet treats of what has been done to exterminate the "gypsy moth." In four years they had expended \$325,000 fighting this insect. The amount of money that said State Board has asked for for the coming year has not been stated. I had correspondence with these gentlemen through their Secretary, Wm. R. Sessions. I asked them to join our efforts to procure parasites, and that a very small portion of their last appropriation, which was \$150,000, would be required. The reply was that the money was a special appropriation, and that no part of it could be used in that way. Then I suggested that in their next demand it be stipulated that a certain portion be set aside for the purpose of searching for a parasite. I have not yet been informed as to the result. I have a clue to the natural parasite of the gypsy moth, and am making preparations to get it. In no other way can they successfully fight this pest, notwithstanding their opinion to the contrary. In their last letter to me they say: "The committee believe that as long as the effort for the extermination is continued it would be folly to expend money in importing parasites, as the killing of the pest would result in destroying the parasites living upon or within it." Very true. The State can reason in this way, on the ground that it is State money; but with our fruit growers, each orchardist must expend money out of his own pocket in the fight. For example, the cost of Mr. Albert Koebele's second voyage to Australia was \$3,712 18. I have expended a large sum in one single year spraying trees, and accomplished nothing, while the results of Mr. Koebele's voyage will save many millions to the fruit growers of the State. I quote from said letter: "The committee are yet of the opinion



that extermination is possible. If our Legislature continues to furnish the means, we intend to accomplish extermination if it is within the bounds of possibility." It is not within the bounds of possibility to exterminate it. The Legislature may continue the appropriation for a few years more, but eventually they will get discouraged at the outlay, and the fight will cease. The spread of the devastating insect will grow until some natural enemy will arrest it. The gypsy moth exists both in Japan and China, and may be brought into California, even with all the precautions we are taking. We have not \$325,000 to fight it.

No country has ever undertaken to exterminate an insect pest with more determination than did the British Government at Cape Colony. I refer you to the Biennial Report of 1887-88, page 160. This experience was with the *Icerya purchasi* (white scale): every plant, shrub, or tree was destroyed—the whole submitted to fire. Mr. Cillie, from South Africa, who was in California the past summer, studying our fruit industries, said that they cut down orange trees two hundred years old, and that after the destruction of plants and trees beyond the border, as they thought, of this insect, it was found in the forests more than a hundred miles distant in the interior.

The *Icerya purchasi* is known in that country as the "Australian bug"; the *Vedalia* as the "California ladybird."

But little is known, comparatively speaking, of the great assistance or the important work of the various ladybirds. There are, so Mr. Koebele reports to me, about fifty species in Australia that prey upon the various insects that disturb plants and fruit trees. About four years ago the walnut trees in my neighborhood were attacked by an aphid. It spread very rapidly and caused the trees, leaves, and small twigs to become as black as the olive tree from black scale. The walnuts were smaller, meat imperfect, and the nuts difficult to husk. It was to me quite alarming. Last year, about the picking time in the fall, I noticed spotted yellow ladybirds in considerable numbers on the trees. Early this spring and as soon as the tree put out its leaves (in our locality this takes place from the 25th of March to April 1st, and in full leaf about the 25th of April), the ladybirds were there in great numbers. On May 28th the second brood were hatching. I might mention, in this place, that while I had not observed in the previous fall but the ten-spotted yellow "ladybird," there were three different ladybirds, in about equal numbers, in the spring on the trees—the spotted yellow, the spotted red, and the common red. In my walnut orchards they could be counted by millions. I at once conceived the idea that they might be useful in other directions. I caught many of them and placed them wherever any species of aphid was at work. I noticed particularly that they devoured the aphid on the orange trees. I caught about one hundred of them and put them on an apple tree infested with woolly aphid. The following day not one could be found; they had flown away in search of more palatable food. Then I collected the eggs. I found the eggs very plentiful in the walnut orchards, mostly on the under side of the leaves, and in clusters of from twenty-five to forty in a place. I plucked two or three of these leaves and placed them in the crotches of two different apple trees, in places where the food was near at hand. The eggs hatched out three or four days after being placed there. The larvæ fed on the aphid, and increased in size very rapidly. I saw them picking up the woolly aphid and carrying it off, as you sometimes see ants carrying crumbs of bread. After

the larvæ had become full grown, they made fast and new ladybirds hatched out, which remained on the trees, and there was not the least vestige or sign of woolly aphis left. Here was the secret of the whole business. In the coming spring I shall have a cluster of eggs placed on every apple tree. This is a very simple thing to do. Once in the apple orchard, they will remain there as long as there is any food. The walnut trees this year had very little black on them; the fruit was good and easily handled. I sent specimens of these three ladybirds to Dr. Horn, of Philadelphia. When I know more about them, will report.

Some ladybirds are migratory in their habits. The *Leis conformis*, sent to me by Mr. Koebele from Australia, and which I have not seen for a long time, were found eighteen miles away; while others apparently have to be transported from orchard to orchard when not more than a quarter of a mile distant.

The fruit growers will have to reciprocate in the distribution of these useful insects, and by giving a little time and study in their management will find great gain in so doing. We have sent out about five hundred colonies of the *Rhizobius*; so that in the coming spring they will appear in great numbers in every locality where sent. There will be, as matter of course, some mishaps, and among the letters we have received on this point, I will read one:

FALLBROOK, CAL., October 9, 1893.

ELLWOOD COOPER, Esq., Santa Barbara, Cal.:

DEAR SIR: In the interest of those interested in the subject of colonizing ladybirds, I will make a report of my experience in that line.

I received the ladybirds on the 5th and let them crawl from the box onto the leaves of a lemon tree, there being twenty-seven of them, and they were very hungry and commenced work at once, by eating one scale in my presence and going to another, over which it stood, and when I went to it later the scale was gone.

I bound straw around the trunk of the tree to insure protection to the bugs, and took every precaution to insure success. On the 6th I went to the tree twice and could find only one bug, and on the 7th I went and could not find any, and when later on the same day I was riding by the tree I saw a swift (lizzard) on the trunk of the tree. It then occurred to me that the swift might have eaten the bugs. I succeeded in catching it after a lively chase. I then cut it open and found six of the bugs that you sent me, and a lot of partly digested insects which I took to be the same kind of bugs. If I had known that there was danger of swifts eating them I would have put tin around the tree.

I have colonized the twice-stabbed ladybird and find that an insect about two and one half inches long feeds on the larva. I don't know the name of them, but have heard them called "Johnny Cackpases." They have a head that turns in all directions; have large eyes and catch their prey with their fore paws or legs, and hold them tightly in their grasp while eating them. Also, I wish to state that the *Rhizobius ventralis* is the only kind of ladybird that I have been able to detect eating scale in its matured state.

Please send some more and I will try and make them a success.

Yours truly,

J. M. MACK.

We have received letters from parties who stated that they saw one beetle picking up six or seven young scales in a few seconds after being liberated from the box. One gentleman wrote that in his orchard were plenty of red scale, and that the *Rhizobius* was eating them by the thousands. Every person who reported (that is, those who watched the beetles carefully after liberating), declared that they went at once to work devouring scales.

One of our greatest enemies in apple and pear growing is the codlin moth. I would urge that a special effort be made to search for the natural enemy of this insect. Another destructive enemy, both to the orchard and the farm, is the grasshopper. The parasite for the latter exists in West Australia; has been known for many years, and can be obtained readily at a moderate cost. (See Annual Report, 1890, pages

39 and 40; also, Mr. Koebele's report to the State Board of Horticulture, pages 19 and 20.)

I have extended this subject in detail for the purpose of supporting my suggestion to have formed a permanent bureau to search for predaceous insects.

Regarding what is known as the Florida purple scale, recent reports of its spread in Southern California are very alarming. I would recommend the most radical measures in arresting its further spread.

In conclusion, I beg to call your attention to the importance of having stricter quarantine laws; no plant or tree that is not free from insect pests or fungoid disease should be permitted to enter the State further than would be necessary to make an examination. Let us in our efforts determine that no more pests shall get a foothold in California. The above is respectfully submitted for your consideration.

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#### COMMITTEE ON RESOLUTIONS.

The President named as the Committee on Resolutions, G. J. Griffiths, of Los Angeles; A. Scott Chapman, of San Gabriel; William Chappelow, of Duarte; H. A. Brainard, of San José; J. J. Pratt, of Yuba City.

THE PRESIDENT: The time for the morning's adjournment having arrived, according to the rules governing the convention, a recess will now be taken until 1:30 o'clock this afternoon.

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### XXI.

#### AFTERNOON SESSION.

The convention was called to order at 1:30 P. M. by MR. LELONG, Secretary, who said: I regret to announce to the members of the convention that the Hon. Ellwood Cooper, President, has been taken ill, and for that reason he will not be able to preside this afternoon. Hon. Abbot Kinney, the First Vice-President, will occupy the chair, and will be assisted by Mr. G. J. Griffiths, the Second Vice-President.

#### VARIETIES OF CITRUS FRUITS.

By J. E. CUTTER, of Riverside.

With the naming of this title the image of the gracious bulk and beauty of the Washington Navel fills the retina of the mind's eye, and we all say, "thou excellest them all." We next wonder if there shall be a future in fruits when another comer will depose this king. We freely admit, however, that his majesty has some very poor relations, which makes us tired, indeed! Your essayist believes that every Navel orange that is distinct from the Washington is inferior to it, though he has noted one at least that was both productive and excellent. From one source comes the claim that by a secret process of crossing, an "improved



Washington Navel" has been obtained. The fruit that has been offered in support of this has failed to show that it was other, or better, than can be found in the orchards of nearly every section; and, to date, the best specimens of oranges that the writer has tasted have been of the regular strain.

While the Navel is the best variety of its season, both orchardists and marketmen know the need of other kinds. Variety is wanted during the time when it is staple, and other sorts must supplement it. Later they must meet the full demand when the Navel's season is past. For the first of these two requirements the St. Michael and the Blood oranges are doubtless the best we have, and they also are the best immediate successors to it. They have been raised in but limited quantity, but growing favor is shown to both by dealers and planters. Both possess excellent shipping qualities and both keep well at a time when many varieties have softened too much for the best carriage. Both are productive, exceedingly so, and the Ruby Blood probably leads all varieties in disposition to early and heavy bearing. In structural characteristics the St. Michael is easily the most elegant of oranges.

Following these is the Tardif (French adjective *tardif*, meaning late), doubtless identical with Valencia Late. This is par excellence the late orange. It is good from May 1st to December, not only good, but better within those limits than any competitor. Its structural characteristics give it the best shipping qualities of any orange, while its crisp, sub-acid flavor—sprightly as a good soda—satisfies the craving of summer. It has a pale rind, while the flesh is of unusually rich, deep color. It is very productive and the tree is a very excellent, strong grower, with but slight thorns.

The foregoing cover the season and make the best list that will do so. There is, however, a long list of excellent varieties, of which some will contend strongly for place among the indispensable few. Prominent among these is the old established Mediterranean Sweet, which has always been profitable; but the Blood, St. Michael, and Tardif are all better fruit and better shippers, and the St. Michael and Tardif are better trees.

The Joppa comes with good credentials, and may yet win place among the especially valuable. Having never seen the fruit the writer is not competent to treat of it here.

In the Tangerine class, the Daucy's and Mandarin rate as standard. The best fruit of this kind that the writer has seen was raised by Mr. Abbot Kinney, of Lamanda Park, and by him termed the "Kinneloa."

Of varieties of pomelo (grape-fruit), there is much inquiry, and but little definite knowledge. As shipped by our Florida friends to the Eastern markets this fruit has found much favor. Of the different varieties probably the Triumph has been most planted in our State. Three years ago the writer received from Florida a very small tree of a sort said to be seedless. The "seedless" story was taken "with a grain of salt," but later a small stock was budded from the tree, which has not yet fruited. Meanwhile Florida papers have reported a "seedless" pomelo of unusual excellence, samples of which came to them from the same place whence the writer's tree was obtained. This, at least, gives good color to the repute which my own tree brought.

Several varieties of lemons have been found thoroughly good, but no one has been acknowledged *best* by general consent. How desirable it

is to determine the preëminence may be judged when we consider that our State gives promise to become the world's greatest lemon district, and that, as yet, we are but opening up the industry. One principle must guide us in this inquiry, to wit: that no lemon that is bitter of rind, whether little or much so, can be accepted. The so-called Sweet Rind, the Bonnie Brae, and others that may have gained some attention, but will not stand this test, must be discarded. Shipping and keeping qualities are also imperatively demanded, so that the Bonnie Brae also fails from its weak, loose, and insufficient rind.

Of the established varieties, the otherwise excellent but weak-growing Eureka is yielding ground, especially in the interior valleys, where its thin foliage fails to shield the fruit properly from the hot sun.

Sicily is a very indefinite term, which has been used alike as a name for some of the best and for some of the very worthless sort. The planter needs always to inquire, "What Sicily?"

Genoa is unmistakably a fine fruit, resembling Eureka, but the tree grows stronger and is of better habit. It has been but little planted.

The Eureka's long-time rival, the mighty Lisbon, still flourishes as the great contestant of all the new introductions. Its fruit is strictly high grade, and cures to the best keeping condition. It is very productive, but against this must be set the fact that it is late in coming into bearing. Its foliage is of light color, but growth is of the heaviest. We may add that when Mother Earth was bidden to bring forth thorns the Lisbon was no doubt there.

The Villa Franca battles with the Lisbon for growing favor on full, even terms. As an early and heavy bearer it probably excels all competitors. It carries few and light thorns. In the severe frosts through which it has passed in Florida it won the repute of being more hardy than other varieties. This seems to be sustained by experience here in December, 1891. Its fruit is judged with the best, both in our own State and abroad.

A late-comer now appears, which shall be more fully described after presenting in tabular form the results obtained in the laboratory of the California State University from chemical analyses of the best selected samples gathered from exhibits at the State Fair held in Colton in March last. The lemons analyzed represented most of the foregoing varieties, and were, so far as possible, selected by the persons in charge of the exhibits, in response to special request from the University, as made to the writer. No. 85 (Royal Messina) was picked in November, as also Nos. 88, 89, and 90. No. 87 (Villa Franca) suffered the disadvantage of later (January) picking, and the date of No. 86 (also Villa Franca) is unknown. No. 85 grew at Nordhoff; No. 86 at South Riverside, and the remaining Nos. (87, 88, 89, and 90) came from one grove in Ontario. In each number, two or more samples were used and averages taken.

	No. 85, Royal Messina.	No. 86, Villa Franca.	No. 87, Villa Franca.	No. 88, Lisbon.	No. 89, Genoa.	No. 90, Eureka.
PHYSICAL ANALYSIS.*						
Average weight, in grammes.....	119	105	110	110	105	105
Rind, per cent.....	25.2	19.1	25.0	29.6	28.5	28.5
Pulp, less juice, per cent.....	25.6	26.2	24.1	25.0	24.9	23.8
Seeds, per cent.....	0.0	1.4	.5	.4	0.0	0.0
Number cubic centimetres of juice, average.....	5.5	5.7	5.5	5.0	4.6	5.3
JUICE ANALYSIS.						
Solid contents by spindle, per cent.....	13.20	10.30	10.60	10.70	10.80	11.15
Total sugar by copper (inversion), per cent.....	3.46	2.12	2.27	1.56	2.44	2.70
Acid (citric), per cent.....	8.40	6.92	7.39	7.84	7.39	7.81

The foregoing analyses average richer and more uniform results than any previously reported by the University. The chemists state that they do not at any time obtain so high percentages of acid as have been reported from tests made by others at Los Angeles. For comparative study therefore the results obtained at each place must be considered by themselves.

The Report of 1891 (University) says: "The relatively large percentage of sugar is a feature that will further commend them [California lemons] to the consumer's taste." This was written of former analyses, but the percentages of three of the six samples shown in the foregoing table are higher than the best reported in 1891. All are good as they stand, except the Lisbon (sugar of), which is low. No. 86 was in an over-cured condition, which may account for an apparent deficiency of peel.

The most prominent feature of the "juice analysis" is the easy and extraordinary superiority of the Royal Messina. It shows *two and one fifth times* as much sugar as the Lisbon, together with decidedly greater strength of acid than any other of the list. In a previous test at Los Angeles it had also shown more acid than the Lisbon, though both were excelled in that respect by an over-cured Villa Franca.

The data obtainable from the foregoing table is the most valuable that chemical analysis has shown in this matter. We find that we have several valuable varieties to choose from. Of these the latest introduction is at once seedless and richest in general contents of juice, in sugar, and in acid. It is high in keeping qualities, the writer having found its fruit sound, and pliable of skin, over eight months after picking the same. The tree is very nearly free from thorns, strong of growth, and of dark and elegant foliage—the best tree yet, so far as observed. It was introduced into this State but four years ago, and its value not being known, it was not pushed until it had time to fruit. Therefore, but few are yet in bearing, but thirty acres were this season planted to it in one grove in Riverside.

I wish to say with regard to the percentage of juice that it was probably due to the slight differences in the curing of the several samples. Whichever samples chanced to be the least cured would stand a fair chance of presenting the highest average of juice, and would compare, consequently, to a disadvantage, but a little more curing would have

\*See protest entered by James Boyd.



brought it down to the same point with the others. However, the averages are there as determined by the chemist of the University. The absolute number of cubic centimetres of juice should not be taken, but the comparative quantity.

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#### DISCUSSION ON VARIETIES OF CITRUS FRUIT.

QUESTION: Is it the percentage or weight in cubic centimetres?

MR. CUTTER: That is absolute, it is the quantity; the Messina showing  $5\frac{1}{2}$  centimetres; the Villa Franca,  $5\frac{7}{10}$  centimetres. When we come to the juice analysis, everything is expressed in percentages. It is in the juice analysis that our greatest interest lies, and while the final analysis represents the value of the lemon for commercial handling, we now, in the juice analysis, get to its value for use. If we were to consider the juice as simply so much pure water, then every one would be exactly alike, but the juice which carries the most of acid and sugar and solid substances will be the richest and heaviest, and therefore the highest percentage of juice will necessarily indicate superiority. The Royal Messina is reported from where it is coming into fruit, that it grows stronger than some of the other high grade varieties. It grows to foliage, and carries its fruit well inside the branches. All of you who are raising lemons, especially in the interior, will appreciate the value of that circumstance.

MR. BLANCHARD: Mr. Chairman, I would like to ask Mr. Cutter if the Royal Messina is generally seedless and the tree thornless. I would also like to know its origin, where it came from.

MR. CUTTER: With regard to its being seedless. It is much the same, in this respect, as the Washington Navel. You know you have found seeds in the Washington Navel, and I have found a seed or two in one, two, or three samples of the Messina. As a rule, I have found it seedless. As to the origin I do not know. It came to us under the name of Sicily, about four years ago. A small stock came from a shipment of trees from Florida. For want of a name, I gave it the term Royal Messina, identifying it with the one that was reported to me so favorably from Florida. Whether Royal Messina is the true name or not, I should still adhere to this and shall introduce it to the public under that name. The tree is nearly thornless. As I said in the paper, it is also a strong grower. The foliage is dark and the tree is of elegant habit. The Villa Franca had apparently shown a greater power to resist frost than other varieties—than the Royal Messina. I would not, therefore, rate it as hardy as the Villa Franca, but I believe the Villa Franca is entitled to the credit of being hardier than any other lemon in this respect.

#### MALTA BLOOD VS. RUBY BLOOD ORANGE.

MR. BOYD: I would like to ask Mr. Cutter whether, in speaking of the orange, he includes the Malta Blood, as well as the Ruby Blood. And whether he finds that there is a difference in quality between the Malta Blood and Ruby Blood. I am informed by competent authorities that while the Ruby Blood has advantages in point of tree, the Malta Blood is as superior in point of fruit as the Australian Navel.

MR. CUTTER: I cannot agree with Mr. Boyd in that matter of the

superiority of the Malta Blood. I have never regarded the Malta as of so fine a quality as the Navel, and although I recognize it as good, I have found many times something peculiar in regard to the flavor that did not exactly suit. In regard to the Ruby, I want to say that some of the best oranges I have ever tasted have been the Ruby Blood, and they have all been young fruit, and they all show the unevenness which is found in the fruit of young trees. However, I have found that often a Ruby is of the very highest character, and its flavor is better by far than that of any Malta that I have ever tasted. It has not, so far as we have had a chance to know, shown the same evenness of the color as the Malta Blood does in the old tree that we had, but whether it will attain that stage or not I leave you to judge from your own experience. The Ruby is certainly, in a good specimen, one of the most delicious oranges.

MR. BOYD: I would like to say, by way of explanation, that my information comes from the owner of one of the leading packing-houses, who, in conversation, informed me that the Malta was a far superior orange, so far as they had seen; that the Ruby was irregular in size and in appearance, and was not equal to the Malta. The Malta was a much better bearing orange, thinner skinned, and in every respect superior looking.

MR. CUTTER: In tests made at the Colton Fair last year, when we came to the Blood orange class, the Blood orange that rated highest and took first premium was a Ruby Blood; the second was a Malta Blood, and some of the Ruby Bloods did not come up to the level of the Malta Bloods, but one of them got ahead. And that would seem to confirm what I said before about the unevenness we may expect from the products of our orchards when they are young.

#### ENTERTAINMENTS.

THE CHAIRMAN: Gentlemen, it has been said that "all work and no play would make Jack a dull boy," and perhaps it would make us so. We have some correspondence here in reference to the play part of this convention, not strictly play either, because we cannot make the excursions that are proposed without gaining a great deal of information. The Secretary will read the letters that he has.

The Secretary then read letters of invitations to excursions, which had been sent to the convention. They were accepted.

On motion, Mr. Lelong was made a member of the Reception Committee.

THE CHAIRMAN: The next paper on the programme is an essay on "Transportation," by Mr. Berwick, of Monterey.

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#### TRANSPORTATION.

By EDWARD BERWICK, of Monterey.

At the last convention of California horticulturists, held in San José, there seemed a prevailing impression that horticulture in this State was sick. It was called a case of over-production; its symptoms, local congestion, threatening to result in dropsy.

Now, they say that "every man is either a fool or a physician by the time he's forty." Nature stamped her forty mark on me many years ago; so, having to choose between being the fool or the physician, I decidedly prefer the latter. This being the case, I, of course, undertook to prescribe a remedy for sick horticulture. My theory of medicine, and I hope yours too, is that "an ounce of prevention is worth a pound of cure." I told the San José Convention that the way to prevent dropsy in their patient was to maintain a good circulation; and that the way to keep up this good circulation of California fruit in Eastern and European markets was to increase and improve our transportation facilities and to put transportation on a right, just, and firm basis.

I presume you all agree with me thus far. One word may divide us: the word "How?"

Before I propound my method I want most emphatically to assure you that I have no sympathy with anarchy; that I am no incendiary, and that I value my own property too highly to advocate the confiscation of another's. Nor do I cherish any animosity against any member of any corporation. On the contrary, I have intense respect and admiration for the enterprise and energy exhibited by the builders of our pioneer railroads, those monumental works of the nineteenth century. I have no wish to under-value or belittle their achievements, and no desire to deprive them of one jot of their just reward. The builders of the Southern Pacific Railroad system (Heaven rest their souls!) are almost all dead, but California fruit growers should never forget that Mr. C. P. Huntington and his late associates rendered possible that present vast development of horticulture, which to-day is the pride and glory of our State.

I am not going to trouble you this afternoon with any bustling array of transportation figures. That's our main trouble already; transportation figures are too many and too big—much too big for the amount of transportation. You can sum up transportation figures and the whole present transportation system in five short words—words too familiar to all present, "all the traffic will bear." You know what that means—"all the producer will bear;" and this frequently amounts to "all the trees will bear."

It means that rates are based, not on any computation of the cost of transportation, but are classed under an arbitrary, elaborate schedule, which shall shear the producer as close to the skin as possible. Here is how the ascending scale is graduated for running a ten-ton car a distance of 125 miles: Hogs, \$25; cattle, \$32; wheat, \$32 50; hay, \$40; apples, \$48. Then stove wood, say rough oak, is \$2 75 per cord, and ten cords make a carload; while peeled oak is \$3 15 per cord, and eight cords make a carload. In one instance under my notice lately apples were sent to a point east of the Rockies for \$1 per hundred, while pears were \$1 25 per hundred. Some articles even appear twice on the schedule at different rates. Millet as bird feed is some 25 cents per hundred more than as seed.

Such a system can never become very satisfactory to the horticulturist. "You fatten the ox and I'll eat the beef," is certainly a division of labor; it can hardly be called equitable.

But such is the system that has obtained, and will obtain, so long as private ownership of railroads is tolerated and human nature remains human nature. As I said, the founders of the Southern Pacific Railroad



are almost all dead, but their heirs, or their heirs' heirs, are with us, and are here to stay. Their system also stays with them, and will stay so long as the people permit it.

What does this all mean but that you are to be the eternal bond slaves of a vast corporation, which will allow *you* the right to live and work so long as *they* reap the harvests that your toil has won. Is this to be the outcome of the great American experiment? Let us face the alternative boldly! Do the people exist for the benefit of the railroads, or the railroads for the benefit of the people? Shall the railroads own the people, or the people own the railroads?

Now, at our San José Convention I had the honor of presenting a resolution, similar to one I will hand to your Committee on Resolutions here, to this effect: That, in the opinion of this convention, the best interests of California horticulturists, and of the American people, demand the nationalization of American railroads.

The time for discussion was then quite brief, and the convention negatived the motion, although our worthy President, in his opening speech, had commended the plan. Probably the majority of that convention momentarily failed to recognize certain facts. Notably they failed to realize that our railroads are merely the nineteenth century evolution from and extension of common highways; that *railroads are in reality the common highways of to-day*, and should be so considered and treated. Railroads bear the same relation to the civilization of to-day that common highroads bore to the civilization of our fathers. Products are carried at least ten miles in railroads for one mile on common highroads.

That San José Convention failed to realize that commerce is the life blood of a nation, and railroads the arteries where the tide of commerce ebbs and flows. It failed to realize that a man might as well trust the circulation of his heart's blood to the control of a vampire as a nation permit its commercial arteries to be controlled by an incorporated company. In both cases such action would be sheer lunacy, and equally suicidal.

Had our statesmen been wise, and foreseen that the railroad was to be the *highroad* of the future, they would have made the building and control of railroads at least as much a matter of governmental care as are common highroads, and there would be now no need of any apparently revolutionary policy.

But is there aught revolutionary in the nationalizing of railroads? I claim there is nothing.

It has ever been one of the first functions of good government to provide means of intercommunication among its citizens. The government of old Rome is remembered to-day by the monumental excellence of its roads and viaducts. If old Rome could furnish its citizens with roads of then unparalleled durability and utility, surely vigorous young America can provide its citizens with the very best class of roads known to this nineteenth century.

Some will shake the United States Constitution at me and tell me the nationalization of roads is unconstitutional. I boldly deny any such assertion. But should every lawyer in America dissent from my view I would then claim that "*man* is more than constitutions."

The founder of the Christian religion announced that "the Sabbath was made for man, and *not* man for the Sabbath." This I would para-

phrase to-day and say "the Constitution was made for Americans, and not Americans for the Constitution."

The welfare of this republic is the highest law, and any lower law conflicting with that welfare must stand from under.

Our ideas of what is constitutional are subject to very rapid change. Let me cite you an instance from the "Review of Reviews" of just such a rapid change in the mother country. Only last June, in the British Parliament, Mr. Gladstone, "and with Mr. Gladstone the House of Commons, woke up to the discovery that what had previously been declared to be impossible, unconstitutional, and most inexpedient, had now become so obviously desirable that *not a single* hostile vote could be registered against the motion."

The motion in question was the desirability of accepting the offer of the American people to conclude a permanent treaty of arbitration for the peaceful adjustment of any and all future difficulties.

Now, I will venture to say that when the question of the nationalization of railroads shall be fairly and squarely put before this great nation, there will not be found in our national Congress a single dissentient voice.

Then we were told, I believe, at San José, that the country was not ripe for this measure. Friends, did you ever know of any reform that, in the opinion of our political spoilsmen and party hacks, the country *was* ripe for?

There is a far feeblér branch from the Anglo-Saxon root, that, with a fifth of our age, and a fifteenth of our population, found itself ripe enough years ago to build and control its own railroads; but it has for its motto, "Advance, Australia!" Shall our motto be "Hang back, America!" or "Go slow, California"? What is possible to such weak sister republics as Chili and Brazil, is surely not impossible to the foremost, the pattern republic of the world.

Another of the so-called facts stated at San José was that this nation was too poor to own its railroads. Let me again point to Australia. Australia was long since rich enough for the enterprise, and found the venture both pleasant and profitable. Are the United States of America less wealthy than the colonies of Australia? Are they less capable?

This great nation spent lives by the myriad and treasure by the billion to free its black slaves; shall it grudge its dollars to prevent the enslavement of its white citizens? We incur a loss of \$100,000,000 annually because of pauperism and insanity now present with us; surely sound policy demands, and amply justifies, such wise expenditure as shall prevent our citizens from being plunged into the depths of poverty, or fretted and worried into the awful abyss of insanity. It *cannot* be that America should plead poverty in a matter so vital, when an old tax-impoveryed country, Germany, where every toiler carries a soldier on his back, can find means to own its railroads.

If there be one object for which our people would cheerfully endure heavy taxation, it would be this; that in this government of the people, for the people, and by the people, the railroads should be the work of the people, operated for the people, and owned by the people. But, with wise management, there should ensue an alleviation rather than any increase of taxation. Such has been the case in Australia, why not here likewise?

The first step in national advancement is to *know what we want*. As

I heard one of our wise men say the other day, "The world makes way for the man who knows whither he is going." Neither political party seems to know just now what it *does* want, or whither it is going, except that both are always as unanimous as Jonah in the whale in wanting and going to loot the treasury.

Let this convention make up its mind what it wants; that it wants the nationalization of railroads; then want it hard, and keep on wanting till you get it. Ask and ye shall receive. Do you say there are lions in the way? There always are, always will be. But advance you boldly. They will retire, or you will walk right over them.

Pull together, and keep on pulling together. Don't be put off by such straw lions as the words "unconstitutional," "impossible," or "inexpedient." "Quit you like men; be strong." That is *expedient* which the welfare of the republic demands. That is *possible* which Americans resolve shall be possible. That is *constitutional* which this mighty nation makes constitutional.

Once more, friends, know what you want! Don't let your party leaders fool you into hostile camps wrangling and snarling over the dry bones of dead issues, or the tweedledum and tweedledee of tariff niceties. Truth is one! Choose for your leaders men of convictions, and men with the courage of their convictions. Your present railroad system antagonizes and insults republican institutions; it aggravates class distinctions, debauches politics, defies the law. You claim to be the sovereign people. Prove your claim! Be once more sovereign! Issue your unanimous sovereign mandate, shake off your shackles, and be once more free Americans, worthy of your sires!

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### CALIFORNIA DRIED FRUIT EXCHANGE.

By E. F. ADAMS, of Santa Cruz.

What I shall have to say will relate wholly to the marketing of dried fruits, of which only I have any such knowledge as would warrant my taking the time of this assembly. The conditions in this branch of our industry are entirely different from those attending the marketing of fresh fruits, either citrus or deciduous, which are sold by different methods, through different channels and by different people. Including raisins, the proceeds of our dried fruits considerably exceed the proceeds of all other fruits and fruit products of the State, wine and brandy included, and the ratio of their greater volume is likely to increase. The importance of the subject is therefore sufficiently apparent.

I shall speak in advocacy of coöperation in marketing, and, as I have had some experience in organizing coöperative fruit-marketing associations, and as these papers are printed for general circulation, I shall not hesitate to begin with the statement of some elementary facts and principles, with which possibly all here are familiar, but which I have found actually new to large numbers of orchardists.

For example, I find that most orchardists think little of any "market" beyond the local buyers whose agents visit their orchards to buy their fruit. Their product, when it leaves their farms, so far as they are concerned, seems to vanish into space. By what routes, and to whose profit it finally reaches the tables of those who eat it, they seem mostly to



have given no thought. As a matter of fact, our product, in the hands of the local buyer, is no nearer market than it was in the hands of the grower. When the local buyer gets it he has to do what the grower might have done for himself—find a customer for it. The market for our dried fruits is with the wholesale grocers, who, through the retail trade, distribute substantially all our dried fruits to the consumer.

Right here let me say that many growers, enthusiastic for coöperation, believe that we should ignore wholesale men and sell to retailers direct. I do not wonder that growers, unfamiliar with mercantile affairs—and it is no more to their discredit to be ignorant of mercantile details than for the merchant not to know how to prune an orchard—should suppose this to be desirable. I will therefore state just why we cannot do it.

Retailers do not buy in carload lots; the overland freight on less than carload lots is prohibitory, and always will be. Hence, selling to retailers involves the maintenance of expensive Eastern agencies selling one article alone in competition with other established firms selling everything the grocer buys. They could eat us up, and would promptly do it. Every wholesale grocer whose field we should invade by seeking his customers would drop California fruits like a hot poker, and put all his strength on imported goods. We could not possibly reach a quarter of the retailers, and, for the portion of the trade we could get from those we did reach, we should lose the trade of all the rest so far as the wholesale man could accomplish it.

Retailers buy on credit. For the most part they will not, and, in fact, cannot buy otherwise. Coöperative concerns must sell for spot cash, as credit involves inevitable losses, which coöperative concerns must not risk. Peddling goods to retailers can only be done at a loss, and will never be tried. Sell to whoever will buy in carload lots, and let that end it.

Our market, then, is with the wholesale grocers. The question is how to reach that market with the least charge on the goods. The answer is simple and obvious. Concentrate our fruit, under our own control, in such quantities that we can fill any order in any amount, of any variety or size desired, and sell it to them. There is no mystery and no difficulty, except the securing of capable men to manage the business effectively and economically, which can always be done by proper judgment.

Commissions on dried fruits are usually 5 per cent. This involves pay for two distinct and entirely different services—first, the concentration of the fruit from the orchards into carload lots at shipping points; and secondly, the finding of wholesale grocers to buy it. The first service is performed by the active young men whom we all know at this end of the line, and the second by another set of equally active young men, whom we never see, at the other end. The commission-house pays both sets of young men out of its 5 per cent, together with telegrams and traveling expenses, and takes the balance for profit. I do not think the rate too high, nor the possible profits unreasonable. We can, however, save one half of it by concentrating our own fruit; but out of that we must pay the expense of concentration and our own telegrams. Out of the whole we ought to save say 1 per cent, which is probably about the usual profit in the commission business.

I have described the commission business as it theoretically is. If all our goods were practically sold that way, possibly there would be no

adequate reason for coöperation; and yet, after all, there is one fundamental and irremovable objection to it—by this means we intrust the selling of our goods to those who have no interest in maintaining prices; on the contrary, as it is usually more difficult to find customers than to find goods for sale, all commission men are bound to sell to customers just so cheaply as they can without absolutely losing the confidence of consignors. So long as they are not obviously underselling they do not care a rap whether the fruit goes high or low; neither, in fact, does the wholesale merchant or the retailer, who only care that no competitor buys cheaper than they. The only parties really interested in prices are the consumers, who naturally wish to buy as cheaply as possible, and the grower, who quite as naturally wants all that the traffic will bear; so that I am not sure that even if the commission business were conducted in an ideal manner it would not pay roundly for the growers to combine and assist in fixing prices for their own goods.

But the commission business is *not* conducted in an ideally honest manner; far from it; it is rotten from end to end, and the primal reeking curse of the thing is that every man, woman, and child engaged in the commission business is also a buyer on his own account, and no human being was ever so constructed by nature or reconstructed by grace as to sell other people's goods squarely and honestly in competition with his own.

There are, I think, in the commission business, men as upright and honorable as I have ever known, but I do not think them equal to this strain; and, if some of them are, we know that there are also among them, as among all other classes of business men, a certain number of very dirty people, and how shall the grower distinguish?

The existing abuses of the dried-fruit trade are about as follows:

1. The grower is utterly uninformed at the beginning of each season of the real value of his product, which will be determined by the amount in stock left over, the prospects for new crops, not only in this country but throughout the world—all fruit crops of all varieties competing with all other crops—and the financial condition of the country.

2. Under this state of things, it is entirely easy, and believed to be common, for a few large operators to make early sales, either real or fictitious, of "futures" at very low rates, causing these sales to be telegraphed back here with the most terrifying accounts of prodigious fruit harvests impending everywhere.

3. Upon which local buyers, often, and probably usually, supplied with funds by the men who have made the short sales, start out to hunt for growers in distress for money, from whom, by the temptation of a good advance paid then and there, they can buy his fruit fresh at rates which will enable the low-priced short sales to be filled at a round profit. A few short sales made East at low rates and a few purchases made here under financial pressure at still lower rates, and the thing is done. The price is set at both ends, and the growers, except the few strong men who can wait till their weaker brethren have sold out, are helpless. And a little later, when the season has advanced and all the cheap goods have been found out and taken into camp, these same men will send their agents seeking consignments to sell in competition with the cheap goods which they have bought and own; and these consigned goods, upon which liberal advances have been made, they take East, where interest and storage accumulate, and one after another the wearied

growers let go and write the agents to sell for what they can get. At the present time there are probably 500 carloads of consigned prunes alone in Eastern cities, and I know not how many of raisins, which the astute buyers at that end know perfectly well are their meat at their own price if they will only wait a little, and that is why we are having a hard market for dried fruit f. o. b. The worst thing to be done with dried fruit is to consign it East. Its proper place is in California until it is sold.

We have endeavored to meet these conditions in Santa Clara County by organization, concentrating our own fruit and selling it, at the same time giving great publicity to the facts affecting prices, and so enabling each grower to judge for himself of values. We have not revolutionized the market, but we have enormously steadied it. The Santa Clara County Fruit Exchange has sold about \$300,000 worth of dried fruit, and will probably handle fruit to the amount of a half million during the year. Other organizations there, working not through us, but in harmony with us, will probably handle half as much more. We have gone a great distance to make improper transactions in fruit impossible, but we have not altogether succeeded; we have too many cheap goods to compete with. In the early part of the season our worst competition was from the south. Knowing positively as we did the shortness of the apricot crop, it was impossible for us to get even 8 or 9 cents for good apricots, when growers here at the south were taking from  $5\frac{1}{2}$  to 7 cents for apricots as good as ours, and as our people had to have money we let them go; but it made our hearts bleed, and we registered a vow to come here before the next season and implore you southern people to join hands with us for our mutual good. And it was no new thing. In 1891 apricots were selling in Ventura County, fresh, at \$15 per ton, when they were selling in Santa Clara County for \$50 per ton; and the freight and waste of the Ventura fruit to suitable drying-ground could not have exceeded \$5 per ton. Just now our worst competition is consigned goods, and we look for no improvement until they are closed out, and we want you here to join us in stamping out that practice, ruinous alike to the consignors and everybody else.

The method which we propose is by the establishment of a State fruit exchange, somewhat on the lines of the Santa Clara County associations. We desire you to concentrate your own fruit by means of local associations, and when so concentrated, while retaining control of the prices, unite with us in establishing one general agency to find customers and distribute information. The proper distribution of information will render it impossible for buyers to get fruit, except from the most ignorant, much below its value, for all growers, when properly informed, may be depended upon to get all they can for themselves. But that is not enough. Growers must not only be informed of the value of their product, but must have a way provided to get that value. We have had experience and we know how to do it. It is not by abusing the middlemen, or cursing the railroad; it is by uniting and acting. Fruit growers of California, shall we unite and act?

A moderate estimate of the result of the work of our Santa Clara associations is that, by the information which we distributed and the steadying influence which we have exerted on the market, we have saved to the people of our own vicinity a quarter of a million of dollars, and to the State at large not less than a half million. If we will all



unite we can double the record, and once more I ask, shall we proceed to do it? The State Horticultural Society, a body of earnest and successful fruit growers, has taken the lead in the matter and caused the formation of a State exchange. We, who were intrusted with that duty, did not hesitate to act, knowing that the time was all too short for what is necessary to be done; but the body which called us into existence, although respectable, is limited in number, and we feel that the organization should really represent the whole State, and that representatives of the whole State should select men in whom they have confidence to go on with it, and to this end a State convention is to be called to meet on the 29th of December, to indorse the act of the State Horticultural Society—which it is not doubted that they will do—and to select the men who shall serve as Directors for the year 1894.

It is my hope that this subject will be deemed of such importance as to warrant reference to a special committee of fruit growers, instructed to report thereon at an early point in our sessions, upon our plans for a State exchange, so that, should they meet the approval of this convention, they may have the advantage of its indorsement.

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#### REPORT ON THE PERKINS PROCESS.

The committee appointed at the late meeting of the State Horticultural Society at San José, for the purpose of considering and reporting upon the process of preserving fruit in storage and in transportation, invented by Rev. A. T. Perkins, of Alameda, have thought it best to form two sub-committees, each to report upon the subject-matters with which they are specially familiar. The first portion of this report, therefore, refers more particularly to the general and scientific aspects of the question, while the second relates to the application of the Perkins process to railroad transportation.

#### REPORT OF PROFESSORS HILGARD AND SMITH, ACTING AS A SUB-COMMITTEE.

The process embraces two main points, to wit:

*First*—The longer preservation of the fruit by the effect of a slow current of air having a minimum temperature of 55° to a maximum of 65° Fahr. passing continuously over it.

*Second*—The maintenance of this temperature at all times in the hot desert as well as in cold winters by appropriate means not involving the use of ice, the refrigeration being accomplished by the expansion of compressed air.

The committee have not had the opportunity of witnessing the process in operation, and as regards the results must rely upon the statements of Dr. Perkins (the correctness of which they have no reason to doubt) and the testimony of one of their number, Professor Smith. The efficacy of a current of reasonably dry air in promoting the conservation of fruit so as to insure its arrival in good condition, even after a considerably longer transit than now commonly occurs, seems thus to be placed beyond doubt. Fruit thus conserved has the additional advantage that upon arrival at destination it will not, under the influence of moist air, become covered with condensed moisture, as inevitably happens when it has during transportation been maintained at a low temperature by refrigeration with ice. That such bedewing of the fruit is highly injurious to its keeping quality is well known. The Perkins process apparently obviates this difficulty and leaves the fruit to arrive and remain perfectly dry. It is but reasonable to suppose that its life will thus be materially lengthened while in the hands of the dealer and consumer—an advantage which it is difficult to overestimate, especially if, as is claimed, fruit to be thus treated may be more fully matured at the time of shipment.

As regards the second point, viz.: the maintenance of the air current at the uniform temperature of say 55° to 60° without the aid of ice, even in the hot desert air, there is no question that it can be accomplished by the means claimed, viz.: the compression of air by means of a pump. Then, after giving it time to cool down to the outside temper-

ature—say 120° at most—allowing it to expand under proper conditions, reducing its temperature, and therefore that of the air current, to 55° or less. The proposition is theoretically sound, and it seems possible to make it practically feasible with perhaps only a slight addition to the weight of an ordinary car in the way of reservoirs and minor appliances, the exact arrangement, size, and form of which must be determined by experience. As regards the maintenance of the same temperature in winter, there can be no difficulty about making the same appliances answer the purpose of heating by the addition of a steam coil or otherwise.

We are, therefore, of the opinion that this invention deserves the most earnest consideration on the part of the fruit growers, transportation companies, and all interested in the fruit industry, since it appears to offer a simple and (as compared with the ice-refrigerating process) inexpensive solution of the problem both of cheaper transportation and of better conservation of fresh fruit for the Eastern and perhaps the European markets.

E. W. HILGARD, Chairman,  
University of California.  
EMORY E. SMITH,  
Stanford University.

THE PRESIDENT: Mr. Chamblin, of Riverside, who is now in the room, has considered and labored about the orange growers in this section, and we would like to hear from him on this subject.

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#### ADDRESS BY COL. T. H. B. CHAMBLIN, OF RIVERSIDE.

GENTLEMEN: I had hardly expected to stand before this convention to-day. My time has been pretty well occupied for several weeks, and, in fact, months, in the matter of organizing the orange growers of Southern California upon lines of marketing their own fruits. I recognize the fact that Southern California, particularly, is a peculiar country—peculiar in soil, in climate, in product. I recognize the further fact that the people of Southern California are a peculiar people, ever zealous in the work of building up and maintaining the reputation of their respective localities. I recognize the further fact that, in certain respects, orange growers, to say the least, deserve a place in the front rank of men for certain remarkable peculiarities. It has been their custom, in times past, to advertise to the world the immense profits in their line of business—a proposition, gentlemen, which stands almost without a parallel in the annals of business and trade. A further remarkable peculiarity has been, that after having invested their thousands in a ranch, after having planted their trees and spent long years of patient waiting and toil to bring their orchards to a bearing condition, and then after having matured a crop, upon which they were wholly dependent for their income, they turn it over, almost indiscriminately, for some one else to dispose of at their own good pleasure, and give them what they might think best. This has been the course pursued.

Now, upon the first proposition, they were not so much to blame, for the reason that many of them, like myself, came to this country seeking for health, either for themselves or for some member of their family; and having been partially restored, they were only too anxious to make known to their friends in the Eastern States the favorable conditions of this climate, and only too anxious to have their friends come and locate near to them. I have a particular love for this Southern California, in that it has given me an additional and unexpected thirteen years of life.

Upon the second proposition, they have been, in the main, engaged in the activities of their ranch and have not been brought face to face with the possibilities of marketing their own crop. But, we have reached a

condition of affairs, gentlemen, that forces us to cast about us and take other methods for taking care of the products of Southern California. And what I may say concerning the orange crop of Southern California, I think will be equally applicable to all kinds of California fruit, particularly the fruit industries of this favored section. In considering this proposition, we find a few features that are absolutely essential in order that we may succeed. The first matter is making absolute provision for the grower, to the end that his crop shall be properly marketed. We must set him at rest, particularly in the matter of marketing his crop. Second, we must give him assurance that his crop will be marketed on the basis of equality with that of his neighbor; and third, that he will receive for his fruit, of like grade and quality, as good a price as his neighbor. With these conditions we set the grower at rest. In our orange growers' organization, we undertake to provide for them by operating upon a united basis.

What I propose to outline now, gentlemen, is a matter of practice, not theory, but of actual experiment. First, we make provision that the fruit shall move from the orchards of the grower embraced in the different associations, upon a pro rata basis; that one grower shall deliver for market an exact proportion of his fruit to that of his neighbor. Second, we propose that he shall receive the same price that his neighbor receives, and that, in addition to that, he shall receive the full average market price for an entire season. To that end we are organizing local associations in the orange-growing districts of Southern California, in which the growers have organized upon a mutual basis, usually taking the form of incorporated bodies. They establish a brand of their own, that is purely local in character, without individual or company names attached. We propose, under this plan, to absolutely place the marketing of the crop in the hands of the growers upon a basis that will perpetuate itself, and in the belief that no individual or company of men shall in any sense have any grip upon the product. Therefore, we say to these local associations: "Establish for yourselves a purely local brand, without any individual or company name attached." The business of the association will then stand under the supervision of the growers themselves directly.

Having established these local associations, we then say to them: Make preparations for the packing of your own fruit upon a line that shall secure the packing and the marketing of the fruit for cost, either by erecting or renting (as they may choose) a packing-house, purchasing their own material, employing their own help, preparing their own fruit for market.

We then provide, further, that upon delivering fruit each man respectively shall receive from the manager of the association a ticket setting forth the number of loose boxes delivered. The moment that fruit goes into the packing-house it loses its identity. We pack the fruit during the season, and at the close of each day's packing we weigh the culls of each variety, and having gone through the season, we then ascertain the gross amount of deliveries, and deducting the percentage of culls from the gross amount of each variety delivered we then ascertain the gross amount of good fruit that we ship to market. Taking the price per pound, we settle with the grower individually, pound for pound, for the fruit he has delivered to the packing-house; thereby the grower receives the full price for the entire season, from the beginning to the close.



That is our plan of operation, and it has been our object and purpose, if this organization should succeed, to widen the field and embrace the other fruit industries of Southern California under one head, and in addition to that to establish in the Eastern cities branch houses, or agencies, employing men of experience, who shall transact the business there for us, men whose interests are identical with ours, and thereby perpetuate the system and carry on the marketing of the respective products of Southern California, particularly those embraced in the fruit industries, under one head.

I will not take your time to outline this more carefully, but we realize this, gentlemen, in Southern California, that we have reached a condition of affairs in which it is absolutely essential that this matter be taken up now by the growers themselves and in their own direct interests. We have various projects on foot in Southern California, and we have also in the State of California.

Now, immigration bureaus are all right, midwinter fairs are all right, exhibits of citrus fruits are all right, but if the present conditions are to continue, gentlemen, and the present methods are to continue, in the marketing of the products of California, of what use is it to invite the people here by our exhibitions? The facts are that the orange growers of Southern California, a very large percentage of them, have not, for the past year, paid their running expenses and the interest on the investment. We need not expect to long continue to hide these facts under a bushel, and the orange growers, as far as I know, in Southern California, have reached this conclusion and determination, and these methods must and shall be corrected in the interest of the product, or the industry must go down. We have, all through Southern California, a large percentage of the crop, as I have said, not paying the running expenses of the ranch and the interest on the investment. We have worse conditions than that, and I understand that the other fruit industries of California are in no better condition. For instance, we have cases in which gentlemen have shipped from ten to fifteen carloads of fruit and have not received a nickel; and you are aware of the condition of the market for deciduous fruit in Southern California. The fresh fruits, particularly white peaches, are put upon the market in Eastern cities and sold at 65 cents a box, under forced sale at auction in the forenoon, and in the afternoon of the same day, the same fruit put upon the market brought \$1 05 per box. We know a gentleman who visited the Eastern market during the busy season, and saw as fine cherries as had ever been grown passed out of the establishment at \$1 25 a box in the afternoon, which in the forenoon of the same day had sold at 40 cents a box at auction. We have no reason to complain of the prices paid by the consumers at the other end of the line. We are satisfied with that, but the leakage between the producer and consumer must be stopped. In order to do this, it is unnecessary to make war upon the gentlemen who have been handling the products in times past. We propose to correct the methods, which are all wrong, and I need but call attention to one feature. These agents come through Southern California early in the season and secure the crop upon a commission basis—so much per box for packing and so much commission for handling in the market. They secure various amounts—some 1,000 carloads, some 800, 400, 300—and the very minute they secure hold on the fruit, they become competitors in the market, in close competition with the growers themselves,

from the same localities, and in precisely the same grade and quality of fruit. The fruit of one grower is then used to undermine his neighbor. Their system is such that they are under the pressure of the growers who are behind them, and with whom they are under contract to market their crops. They are under pressure of finding a market for the very fruit they represent. They are forced to resort to all manner of means and methods, in order to relieve themselves of that for which they are under contract.

Now, in the organization of orange growers we have met with at least a measurable degree of success. We have organizations of this character in all the orange-growing sections of Southern California. They are now in active operation. We are just now completing the details for marketing the fruit at the other end of the line and the matters of detail in handling the crop at this end of the line, and we are hoping, to say the least, for an improved condition of things. [Applause.]

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#### DISCUSSION ON MARKETING FRUIT.

MR. ADAMS: Mr. President, I came here with the hope that some action might be taken on this question of marketing fruit, and I move, Mr. President, that the question of coöperation in the marketing of fruit be referred to a special committee of seven, with instructions to report to this convention at some time on Thursday, in order that the convention may express its deliberate conviction on the general subject.

MR. BRAINARD, of San José: Mr. Chairman, one remark by Mr. Chamblin was exactly in the line of investigation which I have been making, and the point was that we feel perfectly satisfied with what the consumers are paying. I will state, that after making some investigation, for instance, taking the question of prunes—I am a Santa Clara County man, and am interested in prunes—let us say prunes were worth in California 10 cents a pound; this year prunes in California are worth 5 cents a pound. In the East the consumer is paying practically the same to-day as he did last year. So, there is something wrong about that. I have investigated, and I find that in the most of cases that is true—he is paying the same price to-day for prunes that he paid last year. There ought to be 5 cents difference. Now, 5 cents difference in the price of prunes will quadruple the consumption. There will be four times the amount consumed if you can only reduce the price 5 cents a pound. The question I wish to put out upon this convention is, Can there not be some way by which these organizations in California can reach out into that country and control, to a certain extent, the retail price of your products? There is where it finally goes. You may talk about all the generalities and the ways in which it gets there; it has got to go through the wholesale grocers, or through the retail man, but it is the consumer who finally takes it, and it will go no faster than the consumer will buy; that is, eventually. So, if you can attend to that last item, if you can make that a little larger, you have gained a point, and all these other generalities will follow it. Now, if there can be an organization that will reach so far, through these meetings, to control other matters, it will be very easy to stretch that a little further and to a certain extent control the retail prices, which, I believe, have greater effect than we give them credit for.

THE CHAIRMAN: I would suggest that one of the most important things that the State organization can do is a thing that costs money, but it is simple to overcome, in my judgment. It is the least of the three things we have to do. The first thing to do is to thoroughly establish yourself among the people who are to support it, so that when you go somewhere you know that you are representing something. The next thing to do is to establish yourself among the present channels of the trade in such a way that you perfectly understand all their wants, and the third and last step is to reach out from the accustomed channels and start the new things going, which we all seem desirous of doing, but do not see yet how to undertake it, because money is required.

C. C. THOMPSON, of Pasadena: In coöperation let the fruit growers stand hand in hand. I have in my pocket an account of sales, which I got to-day, of fruit delivered four months ago. I have asked for an account of sales twice, and I was very much surprised when I got them to find that I was in debt for the car of fruit. I expected some very handsome returns, because nothing had been said about it; but I was surprised four months after the delivery of that fruit to get a bill of expenses amounting to about \$70 on the car of fruit. Now then, why should not I give a car of fruit at the start and pay in that \$70 to get the association started? It costs us that anyway, and we are kicking about expenses. Now, I am in sympathy with the State organization, with the State exchange. I am in favor of anything and all things that will give us more unity of action, one with another. The time will come when we will get it, and I do not care how quick it comes.

MR. CHAMBLIN: I would like to say a word further in relation to this matter, and that is this: California is to be the great fruit-producing State of this Union. I will refer now particularly to Southern California, gentlemen, and you may apply this to other portions of the State, as far as it may be practicable. I undertake to say that Southern California is built upon the citrus industry. I undertake to say that the citrus industry and the citrus products have developed Southern California so far as it has been developed, and have developed Southern California to a point that it could never have reached but for the citrus industry. I undertake to state, gentlemen, that the citrus industry is the basis of all values in Southern California to-day. I undertake to say that the citrus industry is the basis of the value of brick blocks, and of bank stocks, and of real estate enterprises, and of irrigation schemes, and of everything of whatever nature and character that tends to the development of Southern California. It is all based upon the citrus industry, and we are all suffering from a condition of affairs, gentlemen, that bodes disaster to the industry. The gentleman before me has referred to the fact that bills of expense have been presented to the grower. I want to say to you that it is no uncommon thing for the growers of Southern California for the past two or three years to have bills of expense presented in addition to the credit which they have furnished after years of hard toil, and I want to inquire of any level-headed business man in Southern California, how long can that condition of affairs and the present basis of values be maintained? I want to say, gentlemen—and I wish that I could reach the ears of every Board of Trade and every business and professional man in the State of California, and I say this after mature deliberation and after a thorough canvass of every orange-growing section of the State of California,



and after having handled fruit, and having had growers come to me and recite their experience and their distress in marketing their orange crop—many of their ranches do not pay the interest and running expenses of the ranch. If these conditions are to continue, how long will it be before the orange growers of Southern California shall go down under the Sheriff's hammer? Unless we combine, gentlemen, what is to become of values; what is to become of these great irrigation schemes now partially completed in these mountain ranges, upon which all this territory lying beneath them is dependent for future development?

I want to say again that unless the method of marketing the orange crop of Southern California be corrected, the values in Southern California will have to be cut in two. Therefore, I maintain this, that while it is all right that we combine our energies to the final development of Southern California, while the matter of midwinter fairs, Chambers of Commerce, Boards of Trade, and Bureaus of Immigration are all right, I want to say to you that it behooves every business man, and every mechanic as well as every business man, and every owner of an orange grove, to bend his best thoughts and best energies and attention to the solution of this problem of marketing the fruit products of California. That is the question that now demands a solution, and, in my judgment, gentlemen, the first of all problems that ought to be grappled with and solved promptly. Now, I am glad the gentleman has made the motion he has. Let there be a committee appointed to take this matter under consideration with a view to carrying this movement along, and I think they will act upon lines which will not conflict with the movement among the orange growers of Southern California, for it is contemplated that the field should be broadened, and we shall take under the wing of protection of this organization all the fruit industries of California. Why, gentlemen, the proposition that further confronts us is this: 7,000 carloads of citrus fruits in Southern California to-day—shall it stop there, or shall it grow to 10,000 or 15,000?

The question was put on Mr. Adams' motion, and it was unanimously adopted, and the Chair appointed as the committee the following gentlemen: I. H. Thomas, R. C. Kells, E. F. Adams, T. H. B. Chamblin, H. A. Brainard, Edward Berwick, N. W. Blanchard, and D. T. Fowler.

Recess was then taken until to-morrow at 9:30 A. M.

## XXII.

## TRANSACTIONS OF THE SECOND DAY.

LOS ANGELES, November 22, 1893.

Meeting called to order at 9:45 A. M. by President COOPER.

## RESOLUTION OF RESPECT.

MR. GRIFFIN: Mr. Chairman, the Committee on Resolutions has prepared an appropriate resolution on the death of Hon. J. M. Rusk, which I would ask the Secretary to read.

The Secretary then read the following resolution:

WHEREAS, The sad news of the death of the late Secretary of Agriculture, J. M. Rusk, has come to us; and whereas, Secretary Rusk proved his friendship to the fruit interests of California, and assisted us in many ways; therefore, be it

*Resolved*, That we, the fruit growers of California, in convention assembled at Los Angeles, this, the 22d day of November, 1893, tender to the bereaved family of our late and lamented Secretary, our sympathy and condolence in their great bereavement.

The resolution was unanimously adopted, by a rising vote.

## CURING THE WHITE ADRIATIC FIG.

By GEORGE A. RAYMOND, of Miramonte.

In what I am about to say on the curing of the fig, please bear steadily in mind, first, that I speak of the White Adriatic only; and second, of that fig as grown by me in my own orchard and locality. Of other varieties, other localities, and other methods I have but little knowledge and no practical experience. So I condemn none of these things, claiming no superiority in any respect.

The proper curing of the fig begins with the picking. No one with large, clumsy hands and thick, blunt fingers can pick as it should be done. The stem must be taken, but the skin must not be bruised nor the fruit split. Pick when the fig is fully ripe, but do not use figs that have dropped off the tree to the ground. I differ here from other growers, but I find that a sound fig will not drop, but will dry on the tree, and I also find that the figs that drop are always defective. Do not forget that I am talking only of my figs. Pick in small wire baskets that hang on the left arm, leaving both hands free. Empty these into shallow boxes or baskets. Do not use deep ones, as the fruit is so tender that the lower portion in a deep vessel becomes bruised and worthless for curing. Place the figs carefully on the trays, none touching, all lying in the same direction. Sort into two sizes and keep on separate trays. Use enough sulphur to burn fifteen or twenty minutes, and leave in the sulphur-box an hour. Place the trays on racks in the sun. When one side is bleached, turn each fig over by hand to bleach the other. The

racks for trays should hold them at a convenient height from the ground for the frequent handling they now require. It is palpable that picking can be done only in the forenoon, as the entire afternoon is required for bleaching. In from two to three days begin to roll the figs. This will require extreme care to avoid bursting the skin, as it is still quite tender. In laying down each fig, lightly press it a little flat. The following day they can be rolled much more vigorously, and from now on will stand rough handling. In putting down the figs after the second rolling, press them quite flat. They will then cure more quickly. In another day or two they should be well cured but not dried. Never let them get dry and leathery, as they cannot be restored to softness. Stack the trays for another day or so, and then empty into the sweat-boxes.

At every handling, beginning with the picking, a process of sorting and rejection goes on—the sorting for degree of curing, and rejection of bad and defective figs. The defects are mainly black mold and white, and souring. How to detect these it is impossible to describe—partly by their appearance, but principally by the feeling. Often the bad figs are the largest and handsomest, but they never feel just as a perfect one does. The only rule I can prescribe is, until you have learned the trick, to break open and examine any fig that is in the least suspicious. In this way you will soon learn to detect the bad ones, and it will thereafter become almost instinctive and mechanical. This is a most important matter, as one bad fig will spoil a box. Keep in the sweat-boxes a few days, turning them over every day. Now dip in wire baskets in boiling water with a little rock salt added—about one pound of salt to twenty gallons of water. Dip in and out quickly and with a swash three or four times. This serves to wash off the dust that has settled while the fruit is on the trays. Let the surplus water drain off, and then spread out two or three inches deep on trays or a table, and at once cover carefully with light house lining. This keeps off the flies and other insects, and still allows a circulation of air. If dipped in the forenoon they will be in condition to pack next morning.

I have now fairly covered the entire process, but feel that I have failed to convey an adequate idea of the extreme watchfulness, care, patience, labor, and neatness requisite to make it an undoubted success. Not once, except in pouring daily from one sweat-box to another, can they be handled in bulk. Each fig stands on its own merits, and must be treated accordingly—never slighted. I imagine that figs call for infinitely more labor than any other cured fruit, and the detail is great. Let no one go into this business unless he can and will follow it out thoroughly. Moreover, ascertain first whether your locality is adapted to the fig, for if not you will be greatly disappointed. The trees may grow well and bear heavily, but if the climatic conditions are not right the crop will be useless for curing. However, that is a matter outside of an essay on curing. As to packing, do it to suit your own fancy, only do it well and in attractive form. Something original and novel, if neat and pretty or handsome, will prove of great importance in selling the goods. Do not imitate anything or any person, foreign or domestic, as thus you can never establish your brand and hold your market. If, however, you have something distinctively your own, and the quality of the fruit is good, your hold will become stronger and stronger, and you will be pretty safe against even your imitators.

My object in that last clause is that I have had a great many



inquiries as to my style of packing. The only thing about my style of packing is, that it is my style of packing, and it may be no better than somebody's else style of packing. Of course, you do not want to go on the market as an imitator, and if anybody imitates me they have to go on the market as an imitator. I have not monopolized the market in packing. There are a thousand ways that can be employed. Everybody who wants to go into the packing business wants to get up something that is peculiarly his own. [Applause.]

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### DISCUSSION ON FIG CURING.

MR. BERWICK: I would like to ask as to the cost of the treatment he suggests in drying and handling figs.

MR. RAYMOND: I assume that my figs net me green, as they hang on the trees, about 5 cents a pound.

MR. BERWICK: How much do you get in market?

MR. RAYMOND: I often get 20 cents a pound for figs, and expect that this year.

MR. BERWICK: Do you sell to the Eastern jobbing trade?

MR. RAYMOND: Most of them I sell myself in Oregon, Washington, and California.

MR. BERWICK: Do you sell to the jobber?

MR. RAYMOND: No, sir; I sell direct to the retail grocers. I aim, as a rule, to select the largest retail grocer in the city, and I manage to get to him in some way, generally through a mutual friend. I quote them my price and give them long time. If they want the goods they can have them. I guarantee every box and every fig, and they are at liberty to exchange the box and get a new one if they find any poor ones. In the process of sorting and packing the figs they pass from one hand to another. Some of them are apparently good, but you will find among them some bad figs. The cause of fermentation is generally due to the moisture in the ground or in the atmosphere. I have a neighbor within five miles of me who has trees from the same nursery. He has exactly the same trees. They grow as thriftily as mine. They are handsomer than mine are, if anything. They are larger, but every fig sours on the tree before he can pick it. It was a question for a long time as to what the cause was, and finally I made up my mind that the trouble with him was, he had a large alfalfa field alongside of his orchard. Of course, plants will exhale their moisture, and evaporation goes on through the leaves, and while I had not a particle of dew on my orchard until the latter part of September, his dews commenced about the first of August. The moisture from that alfalfa patch would fall in the shape of dew.

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### OLIVE CULTURE.

MR. HOWLAND, of Pomona: Mr. Chairman, while there seems to be nothing before the meeting now, I would like the privilege of asking Mr. Lelong a question. It has been stated in the Los Angeles papers and in some of the smaller town papers, that Mr. Lelong was the author of an

article in the "California Fruit Grower," decrying the planting of olive trees unless a man had an immense fortune; and as that statement has been seen by a great many people, I would like Mr. Lelong to answer that question.

MR. LELONG: Mr. Chairman, I asked Mr. Howland to ask the question, because there were two small clippings sent to me, one from the Los Angeles "Times" and one from the Riverside "Press," regarding a statement that has been attributed to me, that I have discouraged the planting of the olive. I have *never* written any article and I have never made any such statement. A year ago I was elected President of the State Horticultural Society, and in my address I spoke of the future of the olive and was afterwards requested to write a paper on the future of the olive in California. I addressed letters to a great many growers, and instead of giving my own views on the question, simply brought the replies I received from the growers into the meeting and had them read. Some said, for instance, that there was no money in growing olives, and gave the reason for it. Others said that there was a great future for the olive, and the letters ran in that way. When the clipping referred to reached me in San Francisco, I sent one of my clerks to find out what article this was that appeared in the "California Fruit Grower," and they sent me the article. The editor of that paper asked me one day about pickling olives. I told him I did not care to buy any more olives unless they were irrigated, and that I wanted them irrigated five, seven, or even as many as nine times; that I would pay \$60 to \$80 for the fruit and wanted it picked by hand; that I would allow no fruit to be knocked off the trees, and that I wanted them for pickles and to be of the Mission variety. This did in no way refer to olives for oil. Soon after that I read an article in one of the Los Angeles papers, by Mr. John Calkins, of Pomona, in which the statements made by the growers in those letters were disputed. In another paper before the Society I called attention to this fact, and when printed sent Mr. Calkins a copy. Lately other clippings were sent to me from the Los Angeles "Times," the Pomona "Times," and the Riverside "Press." In these Mr. Calkins is mentioned as the author, in which it is said that I am the author of an article in the "California Fruit Grower," saying that there was no future for the olive. I have not written any such article. The article referred to is the following:

Much talk is indulged in by certain tree growers and many newspapers in this State to the effect that the olive will thrive and bear well almost anywhere, and especially is it often alleged that the tree may be planted on poor land, and that it will thrive without cultivation or irrigation. The "California Fruit Grower" has opposed these theories—they are for the most part only theories—and has cautioned tree planters against expecting any substantial returns from olive or other orchards so planted and tended.

We do not think any olive grower in California can show satisfactory profits from an orchard under such conditions; nor do we think any experienced olive grower would recommend such a course to a beginner.

Perhaps no other man in the State has experimented longer, more diligently, or with better results as regards the olive for pickles, than Secretary Lelong, of the State Board of Horticulture. He has made an entire success with pickling the ripe olive, and also with the production of the fruit for that purpose.

Mr. Lelong would not think for a moment of attempting to grow olives for pickles on dry land, or on rocky hillsides and thin soils. For pickles, a large sized berry is not only best, but very much the best, and a large berry can be produced only by giving the tree the best of care, including plenty of water. The best results ever obtained by Mr. Lelong were, he says, mainly due to seven irrigations in one season, commencing in July. One thorough irrigation in August, one in September, two in October, and two in November completed the seven irrigations, and the resulting fruit was large and fine, making an excellent article of pickle, and commanding a good price.

Mr. Lelong thinks the Mission the best pickling variety with which he has yet had

experience, though he has tried many others. The Mission olive is less liable to become soft and "mushy," and in many respects is the most satisfactory variety for the purpose. [California Fruit Grower, September 23, 1893.]

I have just received the following clipping, also from the "California Fruit Grower," of the 18th inst., which I will read:

*Very Wide of the Truth.*—The Los Angeles "Times" of last week contains a highly erroneous statement regarding Mr. B. M. Lelong, Secretary of the State Board of Horticulture and President of the State Horticultural Society. The "Times" editorial statement regarding Mr. Lelong is made under the heading, "Olive Culture," and is as follows:

"In this connection it may be mentioned that Secretary Lelong, of the State Board of Horticulture, has succeeded in putting his foot in it again, and has aroused much indignation on the part of the olive growers around Pomona, which is the center of the olive industry in this section. That gentleman wrote an article for the 'California Fruit Grower,' in which he advised people not to put out olive trees, as the olive 'was not a profitable thing to raise.' He also stated that the olive should be irrigated at least seven times every year, and said nobody but people of means should have an olive orchard."

In reference to the above we merely have to say that the statement is false. Mr. Lelong never wrote an article for the "California Fruit Grower" taking the ground or making the statements alleged above. The article referred to in which it is alleged that Mr. Lelong made the above statements, appeared in our issue of September 23d. That article was written by the editor of this paper, perhaps a month after having had a conversation with Mr. Lelong regarding olive pickles. In order that there may be no misapprehension on this subject, we give below the part of said article [same as that first read] in which reference is made to the experience of Mr. Lelong. It will be seen by any one who chooses to read, that the assertions of the "Times" editor are not borne out by the facts.

If you will read my reports you will find I have always advocated the planting of the olive, but in doing so I have also advised that those who want to experiment with new varieties should not do it on a large scale unless they had plenty of means; that men of limited means should not plant their orchards to new varieties until their worth is fully proven, which requires many years of continual expense, but should profit by the experience of larger growers. It will be seen by any one who chooses to read that the statements made by Mr. Calkins and the Los Angeles "Times" are not borne out by the facts. The articles which I have just read from the "California Fruit Grower" give my experience in this matter, and I will stand by those statements. I have made no others.

MR. BERWICK: Mr. Chairman, while Mr. Lelong is on the stand I beg to ask him a question concerning the last year's convention at San José. We resolved in San José last year that we wanted the Nicaragua Canal built by the Government, and we directed Secretary Lelong to communicate our resolutions to our Senators and members of Congress. I would like to ask whether that was done, and with what result?

MR. LELONG: It is always the custom, immediately after the adjournment of the convention, that all the resolutions be taken up and at once forwarded to the persons to whom they are addressed. They are certified to under the seal of the Board and immediately mailed. This was done with the resolutions referred to, as well as all others. The memorials adopted in San José were sent to the different members of Congress and to the Senate. When a resolution or a memorial goes into the hands of a Representative he presents that resolution or memorial. These memorials were taken up in both houses.

MR. BERWICK: Mr. President, may I suggest that we instruct our Secretary to keep it up?

On motion, the convention adjourned to meet at 7:30 o'clock this evening.



## XXIII.

## EVENING SESSION.

Called to order at 7:45 P. M. by Vice-President GRIFFITH.

## THE PERKINS PROCESS.

The Chairman announced that a report would be read on the Perkins process.

The following is the report of Messrs. Gray and Bissell:

The two sides of this proposition are Theory and Practice:

*Theoretically*, it would appear from the foregoing report of Professors Hilgard and Smith that there is no reasonable doubt as to the correctness of Rev. A. T. Perkins' invention, in its relation to the preserving of fruit by an even low temperature and constant circulation of dry air.

*Practically*, obstacles may appear in its proposed application, which can only be removed by a series of thorough experiments. The theory, however, is of sufficient importance to be worthy of demonstration to determine its practicability.

R. GRAY,  
General Traffic Manager S. P. Co.  
W. A. BISSELL,  
General Traffic Manager A. & P. Co.

MR. ADAMS: Mr. President, I do not suppose this convention has anything to do with that resolution, or that there is anything further it can do. I think that what the Horticultural Society has secured has been that kind of assurance in the premises which would warrant the patentee in going on with a reasonable assurance that he will receive the cooperation of the railroad in the practical tests which must be made, and that the result will be awaited with interest by all fruit growers. It is evident to all of us, I should imagine, that a cylinder of compressed air can be carried with less expense in a car than a room full of ice, and that the cylinder weighs less than the car to carry the ice, and it would not appear that there would be any practical difficulties arise which could not be overcome. If it succeeds, it means a lot of money to the fruit growers, and we wish godspeed to the inventor and to those associated with him in his experiments.

THE CHAIRMAN: As Mr. Perkins is here, we might hear from him on the subject. It certainly is a subject which interests all as growers, and if there can be any light thrown upon the subject it will result in great good to us all.

MR. PERKINS: Mr. President, perhaps anything I might say before this convention would be only reiterating what I have said at the meeting of the State Horticultural Society and fruit growers at San José. And yet, right in this connection, I wish to say that I believe we all, acting as impartial judges, feel that serious charges have been made against the railroad company and we are losing track of this: that while they are endeavoring, as far as possible, to gain money for themselves, they are in a measure helping the fruit growers. While I am not attempting to champion the railroad, still I wish to place a few figures before this convention, because I think, perhaps, it may open the eyes of some of us. Let us then take the rate from Sacramento to Chicago—\$300 per car; adding the refrigerating charge of \$125, or \$425 for the car, for carrying ten or, as they claim, twelve tons of fruit. I believe the charges

are \$440 from San José and \$450 from Fresno. Taking, then, the minimum rate of \$425, and what do we find as the result to the railroad company? \$125 goes to the refrigerating company—it cuts no figure as far as the railroad company is concerned. Here is simply, then, \$300 charges, and of that amount 15 per cent goes to the railroads east of the Missouri River. There is a charge of \$10 per car for crossing the bridge at Omaha, and that leaves for the Southern Pacific, for hauling the fruit over the mountains, simply 45 per cent of 85 per cent, less \$10. Now, in the refrigerator cars this means that the railroad company is required to haul that ten tons of fruit, nominally twenty tons of dead weight in ice; and the return of the car, leaving out the ice, is from 14 to 15 tons—calling that only ten tons, makes four parts of the charge—therefore, your fruit has to pay four times as much for the haul as it would if you used an ordinary fruit car, for which the Southern Pacific receives simply \$2 29 per ton from Sacramento to Ogden. And I ask you gentlemen here if you suppose it is possible for the railroad company to carry products for any less price than that, in such a car as they are compelled to use. But if they receive four times that amount, which is \$9 16 per ton, bear in mind that if they are to carry dead weight, whether it be fruit, or pig iron, or anything else, it means an expense of so much per mile. Now, it does seem as though in the attempt to solve the problem, that it would have the hearty and earnest coöperation not only of the fruit growers, but of the transportation companies. This question does meet with a great deal of interest from one side, and that is the transportation company, because in the process which we are attempting to bring out, whether it is a success or not, it is just as much in your interest as it is in the interest of the transportation company, for we will not exceed two tons of dead weight that will have to be carried.

An ordinary fruit car is 28,000 pounds, or 14 tons. Our car will weigh probably 30,000 to 32,000 pounds, not to exceed that. The average refrigerator car runs from 45,000 to over 50,000 pounds, and the ice added. You can very readily see, then, that if the railroad company is contented to carry your fruit at the present price, or at the rate of \$2 29 per ton, that if it does not have the dead weight to haul, at least it will give you a portion of that which it has been receiving, if you demand it. Therefore, it is a saving to you, and at once you can afford to allow the railroad companies to receive a greater price for their service.

In connection with that, the average price for icing a car, taking the season through, is from \$90 to \$100. Of course, early in the season, when ice is plenty, the charges are not so high, and wherever ice may be gathered at a small price, the charge for icing is small, merely nominal. But there is a certain portion of the season in which it is necessary to pay from \$10 to \$12, and sometimes \$15 a ton for ice, bringing up the rate, taking the whole season through. This process, if it be successful, will save all that.

Now, the rate per ton to Chicago averages, taking the season through, \$40. It is possible that the railroad company could make more money than they are now making in the refrigerator service (and I am not talking against the refrigerator service, because there will be enough for them to do, and enough for any other service also). I believe it to be possible, and it is important for you to work earnestly for that time when you can save \$20 per ton on every car of fruit you send East;

that is, your fruit will cost you, for the hauling and for the process, not to exceed one cent per pound.

I think you can see very readily, if you are willing, that with all the varied means that you have to reduce the cost of production, of packing, of grading, of processing, and of putting on the Chicago market, so that it can be sold for 5 or 6 cents per pound, you can then raise just as much fruit as you choose and you will find a market for it. Gentlemen, this is what we are trying to do, and we hope to have your hearty support. Of course, if I entered into the subject of how we are going to carry this out, it would require a considerable time for explanation. In the last report which has been offered it has been said that the whole thing is experimental. To be sure it is, but we have tried this process carefully for the last three years. I have been at work upon it between six and seven years, and the result is that I was able to show before the convention in San José—and I am sorry I have not them here now—grapes that were put in the process in the year 1891, cherries that were put in the process in the same year, in which decay was absolutely arrested by the process. It is only the carrying out of a natural law. We propose to use compressed air, but if we find that there are obstacles in the way which we cannot overcome, we still have two or three methods to try, and I think that one of the three will solve the problem.

THE CHAIRMAN: Professor Hilgard is here. We would like to hear from the gentleman who made a report on the subject.

PROFESSOR HILGARD: Mr. Chairman, the speaker before me has dwelt upon the diminution of cost. I think we all can easily understand how this diminution is to affect the consumer. I take another standpoint, which from the experience I have had I have no reason to doubt will be justified, and that is this: At the present time we depend upon the speed of the cars to a very great extent; the railroad is compelled to run fast trains for the fruit. According to all the testimony we have in regard to the Perkins process, it appears that the fruit would appear upon the market in the East in 'so much better condition that it would not be required to be sold in the haste in which it is at the present time, and the railroad would not be required to run the cars as fast as it does now, at heavy expense. Fast trains cost more than slow trains. If the fruit can, as we have reason to believe, be put upon the market in Chicago in a condition in which it will last a great deal longer, if the fruit should not be salable at the moment, we will be able to wait for the market to a certain extent. If any of you have ever been present at the opening of a refrigerator car, in the East, when it arrived from California, you would see that when the weather was at all damp, the fruit was covered with a dew of water in the course of a few hours, and after the spot of moisture appears it soon causes a spot of brown to appear on the grape. This would be obviated by carrying the fruit at a temperature so nearly the one in which it is to be marketed that it would remain dry. That I conceive to be one of the great advantages. I think, as regards any action by this convention, that a strong expression of the desirability of attaining these objects—the diminution of cost, the better preservation of fruit—a strong expression that this is an object so desirable to be obtained, that the railroad and others pushing the enterprise be strongly urged to bring this matter successfully to a definite conclusion, would encourage the railroad to lend its aid in this direction. I have reason to believe so, from the personal interviews I have had with the railroad



authorities, and I think that an expression on the part of this convention would be useful.

MR. MASLIN: I move that this convention heartily sympathize with Dr. Perkins in his efforts, and that a statement be made to the railroad company of the condition of his work, and we respectfully urge the railroad company to facilitate the matter.

Motion adopted.

MR. ALFRED HOLMAN, of San Francisco, then read the following report of the Committee on Markets and Transportation:

### MARKETS AND TRANSPORTATION.

GENTLEMEN: Your committee appointed at San José on October 27, 1893, to investigate:

1. On the prospects of finding a market in the cities and sections not yet reached by growers and associations;
2. On the prospect of securing quicker time for fruit shipments; and,
3. To report on cost of picking, packing, handling, and transporting fresh deciduous fruit in carload lots, with the view of ascertaining the proportion received by growers from gross sales of shipments to the Eastern markets—beg leave to report:

*First*—From information received from the railroad companies and other sources we find that there were shipped, for the fruit season of 1893, up to and including the month of October, from Sacramento, 4,372 cars, consigned to the following points. This statement covers shipments from Sacramento only. The greater number of these cars contained upwards of 24,000 pounds of fruits:

*Fresh Fruit Shipments from Sacramento, June to and including October, 1893.*

Destination.	No. of Cars.	Destination.	No. of Cars.
Aberdeen, Col.	1	Minneapolis, Minn.	189
Boston, Mass.	187	Mitchell, S. Dak.	1
Buffalo, N. Y.	16	McPherson, Kas.	1
Baltimore, Md.	2	New York City, N. Y.	857
Burlington, Ia.	6	New Orleans, La.	69
Butte, Mont.	52	Omaha, Neb.	171
Chicago, Ill.	1,955	Philadelphia, Pa.	34
Cleveland, O.	46	Phillipsburg, Mont.	—
Cheyenne, Wy.	7	Pittsburg, Pa.	18
Cincinnati, O.	4	Peoria, Ill.	3
Davenport, Ia.	5	Pueblo, Col.	9
Denver, Col.	150	San Antonio, Tex.	6
Des Moines, Ia.	1	St. Louis, Mo.	71
Dubuque, Ia.	8	Sioux City, Ia.	28
Grand Island, Neb.	2	Sioux Falls, S. Dak.	62
Helena, Mont.	51	St. Joseph, Mo.	13
Galesburg, Ill.	1	St. Paul, Minn.	109
Houston, Tex.	3	Spencer Port, N. Y.	1
Kansas City, Mo.	100	Spokane, Wash.	9
Kearney, Neb.	3	Spring Valley, Ill.	1
Lincoln, Neb.	49	Toronto, Canada	1
La Crosse, Wis.	1	Toledo, O.	1
Leadville, Col.	2	Winnipeg, Canada	8
Louisville, Ky.	8		
Milwaukee, Wis.	20		
Montreal, Canada	33	Total	4,372

This leaves 29 cities in the United States, with a population in excess of 50,000, to which no fresh deciduous fruit is directly shipped from California. Many of these are in sections in which we can hope for but

little demand for our products, and others derive their supply from the great distributing centers. Enough, however, remain to show that there is still a vast unworked field for the introduction of our fruits. The list above given shows the points reached. As it may be of interest to know where our fresh fruits do not go, the following list of these cities is appended:

*Cities and Towns of Over Fifty Thousand Population to which No Shipments of California Fresh Fruits are Made.*

Albany, N. Y.	94,923	Lowell, Mass.	77,696
Alleghany, Pa.	105,287	Lynn, Mass.	55,727
Bridgeport, Conn.	48,866	Newark, N. J.	181,830
Cambridge, Mass.	70,028	New Haven, Conn.	81,298
Camden, N. J.	58,313	Paterson, N. J.	78,347
Charleston, S. C.	54,955	Providence, R. I.	132,147
Columbus, O.	88,150	Reading, Pa.	58,661
Dayton, O.	61,220	Rochester, N. Y.	133,896
Evansville, Ind.	50,756	St. Joseph, Mo.	52,324
Fall River, Mass.	74,394	Scranton, Pa.	75,215
Grand Rapids, Mich.	60,278	Trenton, N. J.	57,458
Hartford, Conn.	53,230	Troy, N. Y.	60,956
Indianapolis, Ind.	105,436	Washington, D. C.	230,329
Jersey City, N. J.	163,003	Worcester, Mass.	84,655
Louisville, Ky.	161,129		

The chief distributing centers now reached, and at which regular auction sales of California fruit are held, are Chicago, Minneapolis, St. Paul, Kansas City, Pittsburg, New York, Cleveland, Buffalo, Boston, Philadelphia. There are one or two other points where auctions are held when fruit arrives in quantities. Dividing the United States into six shipping districts, we find that—

The seaboard district, including New York, Boston, Philadelphia, and Baltimore, took	1,370 cars.
District including Ohio, Kentucky, Tennessee, and part of Southern Illinois, took	138 cars.
District including Mississippi, Alabama, Georgia, part of Florida, and New Orleans, took	159 cars.
District west of the Mississippi River, excepting Colorado, took	1,030 cars.
Colorado took	291 cars.
While the district including part of Illinois, with the cities of Chicago and St. Louis, took	2,435 cars.
Total	5,423 cars.

The facts and figures above presented show those sections which we do not reach, or reach only to a very limited extent.

#### CONCERNING FASTER SERVICE.

In respect to the second point under consideration, the securing of more rapid transportation, your committee would report that in the course of their investigations they interviewed personally or by correspondence the traffic managers or other officials entitled to speak for the Southern Pacific, the Atlantic and Pacific, the Union Pacific, Rio Grande Western, Chicago and Rock Island. The Southern Pacific assured us that the fault was with the Eastern companies, who do not fully realize the importance of the fruit industry or the necessity for quick time in fruit transportation. Mr. Gray stated that his company had promised to give 45 hours to fruit trains to Ogden, and that they had made within half an hour of schedule time. He gave the assurance that his company was fully alive to the importance of the rapid

movement of fruit trains, and would coöperate with any movement which the fruit growers would make to that end. This assurance we consider very important in its relation to the outcome of inquiries made elsewhere and reported below.

Later, Mr. Rowley, a member of our committee, had an interview with Mr. G. W. Luce, General Agent Freight Department of the Union Pacific Railroad, and that gentleman expressed the attitude of his company as follows:

Permit me to state that while we do not desire to endeavor to shift the burden from our line and its connections east of Ogden to that of the Southern Pacific Company, yet I desire to say that the line east of Ogden was more regular, and the trains were handled at a greater rate of speed than west of Ogden, and, in connection, I wish to advise that we made arrangements with the Southern Pacific Company last season to make 45 hours to Ogden, in which case we were to make with our connections (Chicago and Northwestern, or the Chicago, Milwaukee, and St. Paul) 80 hours Ogden to Chicago. We further endeavored to arrange for the past two seasons, to have the Southern Pacific Company make 36 hours Sacramento to Ogden; we, in that case, would be willing to make 75 hours Ogden to Chicago, actual running time Ogden to Chicago to be 72 hours, and three hours for switching in Chicago. Will state, further, that we stand ready to make this arrangement for the next season's business.

Would suggest in connection with the above, if it be possible, you arrange a regular time for departure of these fruit trains from Sacramento, and schedule the same to arrive at Ogden at a certain hour. If this can be done, it will insure much better service through than if the trains are delivered to us at Ogden irregularly.

The Union Pacific have always recognized that fast service is necessary in the handling of deciduous fruits of California, and it has always been our aim to coöperate with our connections to the fullest extent with this end in view, and we will heartily do so in anything they might suggest which would be the means of placing the fruit in the very best time in the markets of the East, which we appreciate is growing each year, and it is our intention to foster the industry, and to assist in placing the fruit at its destination in the best possible condition.

With a view of ascertaining what time could be had by diverting fruit shipments at Ogden via the Rio Grande Western, the Denver and Rio Grande, and the Chicago, Rock Island, and Pacific railways, we made inquiry and were informed by Mr. W. H. Snedaker, Western Representative of the Rio Grande Western, that his road was prepared to give California fruit shipments prompt service in trains of eight to ten cars, from Ogden to Pueblo in 36 to 40 hours. In this connection Mr. Frank McCormick, Western Representative of the Chicago and Rock Island, stated that his road would coöperate with their connections (the roads above named) in giving quick service, naming 42 to 44 hours from Pueblo to Chicago. This would make the time from Ogden to Chicago, by the Pueblo route, 78 to 84 hours.

From these statements it will be seen that if the Southern Pacific Company will coöperate with its Eastern connections in the matter of reducing the time of transporting fresh fruits to Eastern markets, a very material reduction can be made in the time consumed in transit, as compared with the record of the past season. By study of the above propositions it will be seen that they promise 111 hours (by the Union Pacific) or 116 (by the Pueblo route), as against an average of 192 to 216 hours for the fruit shipments of 1893. There are two contingencies—both very important—namely, (1) That the Southern Pacific will shorten its time from 45 to 36 hours between Sacramento and Ogden, and (2) That the Union Pacific and the other roads named live up to the propositions as above quoted.



## CONCERNING FREIGHT RATES.

Incidentally, your committee investigated the question of a reduction in freight rates from California to Eastern points, but received no encouragement from railroad companies in this direction. The Southern Pacific claims that it is now moving fruit at the lowest profitable rate, and that the mileage rates from California are now much lower and the service better than those from Florida fruit districts.

In a communication from Mr. Gray, Traffic Manager of the Southern Pacific, the following statements are made, which are here presented as giving the railroad view of the matter:

The fact is, speed of transit, weight of rolling stock, and other matters taken into consideration, the California fruit service is now done more cheaply and on a smaller margin of remuneration to the carrier than any similar service in the world. I inclose a copy of statement showing the rates on oranges from Florida to Chicago, St. Paul, Cincinnati, St. Louis, and Kansas City; also showing the rate per ton per mile from San José, Cal., to same points, and also to New York City. By this it appears that our rate varies from \$1 12 per ton per mile to Cincinnati—which city we reach by paying an arbitrary local rate—to 87 cents per ton per mile to Boston, while rates from Florida points range:

To Chicago, from \$1 31, the lowest, to \$1 73.  
 To St. Paul, from \$1 37, the lowest, to \$1 49.  
 To Cincinnati, from \$1 37, the lowest, to \$1 92.  
 To St. Louis, from \$1 54, the lowest, to \$2 01.  
 To Kansas City, from \$1 70, the lowest, to \$2 61.

When the character of the service is taken into consideration, there is no comparison between our rates and those at the East. I am told it frequently takes longer to get fruit from Florida to Chicago and points in the Northwest than from this coast to same points, notwithstanding the fact that we have to overcome several ranges of mountains.

To correctly understand the situation and the rates charged, it must be remembered that a large portion of the deciduous fruit is now transported in refrigerator cars.

The minimum weight of fruit in these cars is 24,000 pounds, the rate on which to Chicago being \$1 25 per 100 pounds from San José, the cost would be \$300 per carload of 24,000 pounds. For the service west of Ogden the amount received by the Southern Pacific Company is \$140 76.

The weight of an ordinary fruit car is .....	24,000 pounds.
Excessive weight of refrigerator car .....	16,000 pounds.
Excessive weight of refrigerator, return .....	16,000 pounds.
Weight of ice East bound .....	8,000 pounds.
Weight of fruit .....	24,000 pounds.

Total weight .....	64,000 pounds.
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Dividing this total weight (64,000 pounds) by the revenue west of Ogden \$140 76, gives 22 cents per 100 pounds, or an average for 870 miles between San José and Ogden of, in round figures, one half a cent per ton per mile.

From a railroad standpoint the only apparent hope for lower freight rates lies in the replacement of the present cumbrous system of refrigeration with some appliance equally effective and of less weight.

## CHARGES FOR PACKING, CARRYING, ETC.

In regard to the third matter under investigation, your committee addressed a number of letters to prominent fruit growers and shippers, asking for information that would form a basis for estimating the cost of picking, wrapping, boxing, hauling, and placing on board the car, and transporting to the East the various kinds of fruit. To these letters several replies have been received, and to their authors your committee is indebted for the following facts and figures. We find that the several charges above enumerated average for each package as follows:

Peaches, boxes .....	\$0 64
Pears, boxes .....	1 23½
Cherries, boxes .....	49
Apricots, boxes .....	66
Apricots, crates .....	70
Plums, crates .....	70

If your fruit sells for an amount in excess of these figures, such excess represents your profit, less commission paid on such excess. These figures are based on shipments in refrigerator cars, and represent the average cost of all expenses incidental to fruit shipments from orchard to Eastern purchasers, cost of cultivation, and value of fruit—nothing taken into consideration.

#### SUGGESTIONS IN CONCLUSION.

Referring again to the first object of our inquiry, namely, the question of putting California fruits into markets not now reached, there is small satisfaction in the statistics which we have presented: That in the vast region comprising the populous States of Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, New York, Connecticut, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, and North Carolina we sell on an average yearly 1,370 carloads of fresh fruit; that in another great region comprising Ohio, Indiana, Kentucky, Tennessee, and the southern third of Illinois we sell only 138 carloads; that there is a list of nearly thirty towns in the East, each of fifty thousand inhabitants and upwards, to which California fruits never go direct. These facts are interesting enough, but they have no real value save as they confirm the familiar statement that our products are not fairly put into their natural markets; that the districts in which our fruits are offered to consumers are almost insignificant when compared with the wider districts where fruit is wanted, but to which it never goes. These facts lead up to and point distinctly to one conclusion, namely, that the methods of distribution currently practiced are pitifully inadequate and inefficient.

The present method of marketing our fresh fruits is the dispatch of carload lots to a few central points, where they are sold at auction for local consumption, or, possibly, for reshipment in small lots to contiguous communities. No direct shipments are made to points where the local demand will not justify the sending at one time of a whole carload; and it is for this reason that so many large towns never get a taste of California fruit. Since they cannot take a carload of 24,000 pounds, then we cannot serve them at all. We are told by experts that from a railroad standpoint this is the only practical method of shipment; that to dispatch a single car with two or more distinct consignments for two or more distinct points on direct lines of road is practically out of the question. It would be as presumptuous as it would be rude to question the expert ability of the gentlemen from whom our committee has made inquiry or the sincerity of their replies; but we believe and claim that an utter misconception of the conditions and requirements of the fruit traffic lies at the foundation of their theories. A system of shipment from the places of production to central points, with reshipment from these depots to minor points, will do well enough for miscellaneous perishable commodities, but in the case of fresh fruits it is totally insufficient. The application of this system to California fresh fruits and the Eastern markets involves practical elimination of all but the large centers from the field of consumption, and so contracts the volume of our sales. How this affects the producer need not be told.

ALFRED HOLMAN,  
B. N. ROWLEY,  
JOHN ISAAC,  
Committee.

## SUPPLEMENTAL REPORT.

When our expert friends declare that it is not possible to ship direct to points which cannot take a full carload, they have in mind the conditions and regulations which now prevail on the railroad lines with which we deal. And this brings us to the point that the railroads have taken no steps in the way of providing a suitable equipment for the California fresh-fruit traffic. Apparently they do not realize the magnitude of the trade, nor understand its requirements. To this great special traffic, the very life of which depends upon their coöperation, they give only such rough-and-tumble facilities as belong to a miscellaneous freighting business. Now, if the roads had for the California fresh-fruit traffic special cars built with compartments; if they had a sufficient number of these cars to meet all demands promptly; if they had locomotives in sufficient numbers to haul them promptly and rapidly; if the fruit trains were given the same track rights allowed to express trains—if these suggestions were realities, does any man of sense doubt that some things which the experts declare impracticable would be very simply and easily done? For example, would it not be possible under such conditions to load a six-compartment car at Vacaville or Ontario with six separate lots of fruit for the six cities of Tiffin, Mansfield, Canton, Zanesville, Columbus, and Springfield, all in the State of Ohio, and to make the deliveries in a satisfactory way? Does anybody doubt that it would?

It is our judgment that to reach new markets some such combination of equipment and train service is essential; but it would be Utopian to expect it to come of its own motion. Its natural and essential prerequisite is the creation at this end of the route of a shipping system which will require and exact such service. The great express companies, not the railroads, have made the American expressage system, with its messengers on every train, its depot at every railway station, and its distributing servant in every village. As the necessities of the service grew the railroads, under the pressure of specific demand, provided them; but if they had been left to their own devices, the great expressage system would never have been brought into existence. And so it will be with us. So long as we leave our necessities without organization to plead feebly for themselves, we shall have just the kind of service always given to an unsystematic traffic. When we have created a shipping system ready to operate as the express companies do, then we shall secure facilities for transportation proportionate to the magnitude and value of our fruit interest.

Opinions differ widely as to the right way to create such an organization. We are told by persons who are entirely sincere, that the producer is outside of his natural sphere when he undertakes to be his own marketer; that, like a certain brand of sarsaparilla, fruit selling is a thing peculiar to itself and that it must be left to experts; or, in other words, since fruit production is one thing and fruit marketing another, that the producer should stick to his orchard and leave the distribution of his product to the commission merchant. Now, we agree that fruit marketing is a special trade; that it calls for business training and acquaintance with markets, etc.; but we deny that these qualifications are found with commission men more than among the producers themselves. As a matter of fact, after many years of trial, the commission



system has failed. It does now but what it did in the beginning, namely, it sells our fruits at auction in a few general markets. It has not, like the great oyster companies, like the great express companies, like the Standard Oil Company—not to mention a dozen other equally notable instances—established agencies away from the centers and so widened the field of fruit consumption. The inefficiency of the commission-house system is demonstrated by the fact that after many years of exclusive control of our business, our fruit products are still unknown, or at least not commonly sold, in the larger part of the Eastern market.

And the fact of inefficiency is not less clear than the cause of it. Generally speaking, the commission interest is foreign to us. It has only a commercial relation to us—about the same sort as California merchants have with the people of the Sandwich Islands. It is not possible under such conditions that our work should be well done. And, in our judgment, it will not be well done until the California spirit is in it. It is our profound conviction that the future welfare of the fruit interest of California, as it is dependent upon the Eastern market, rests upon the coöperative support of a State exchange operated in the direct interest of the fruit growers, and having its agencies not only in the great cities but throughout the whole vast region beyond the Rocky Mountains. What Adams & Co. can do, what Wells, Fargo & Co. can do, what the Standard Oil Co. can do, what a firm of Yankee shoemakers can do, surely the great horticultural interest of California can do. We are told that suitable men cannot be found to work for an association; that expert commercial ability can only be developed by the interest of personal ownership. We don't believe it. The express companies and the railroad companies seem to be served by paid agents with ability and devotion, and there is no reason why we cannot find men to do our work in the same spirit. The career of the California Fruit Union proves that the coöperative principle can in fact be successfully applied; and what, let us ask, would be easier than the evolution of such a system as we suggest from such a good foundation as this same Fruit Union affords?

For the suggestions herein embodied we claim no credit for originality. If nobody else had ever thought of them before, we should distrust our own judgment. But we have only set down things long familiar to everybody. As regards the plan of shipment direct to minor points in broken loads in compartment cars, so competent a railroad man as Mr. W. H. Mills long ago suggested and approved it; as to the suggestion for general coöperation, that happily seems in a fair way to be made a reality. The two things together, your committee believe, are the best hope of the California horticultural interest.

ALFRED HOLMAN.  
JOHN ISAAC.

MR. ADAMS: Mr. Chairman, I think when gentlemen take the pains that these gentlemen have to secure information for us, that it requires some recognition, and I move that the thanks of the convention be tendered to these gentlemen for their exceedingly important and valuable report; and also that the editors of the "Rural Press" and "California Fruit Grower" be requested to publish the report in full; and also in order that the facts may be put before the people earlier than through the natural publication of the report by the State Board of Horticulture,

that this paper be published as a separate pamphlet by the State Board, so that we can get at these figures and have them understood.

Adopted.

[The report was published in pamphlet form, and a copy was sent to Mr. Smurr, General Freight Agent of the Southern Pacific Company. He at once sent the following communication, which is herewith attached:]

OFFICE GENERAL FREIGHT AGENT (PACIFIC SYSTEM),  
SAN FRANCISCO, January 18, 1894. }

*To the honorable State Board of Horticulture of California:*

GENTLEMEN: In your Bulletin No. 65, subject, "Fruit Markets and Transportation," you publish the following statement from the General Agent of the Freight Department, Union Pacific Railway:

"Permit me to state, that while we do not desire to endeavor to shift the burden from our line and its connections east of Ogden to that of the Southern Pacific Company, yet I desire to say that the line east of Ogden was more regular and the trains were handled at a greater rate of speed than west of Ogden, and, in connection, I wish to advise that we made arrangements with the Southern Pacific Company last season to make 45 hours to Ogden, in which case we were to make with our connections (Chicago and North-western or the Chicago, Milwaukee, and St. Paul) 80 hours Ogden to Chicago."

And your committee to whom this matter was referred, report that:

"From these statements it will be seen that if the Southern Pacific Company will co-operate with its Eastern connections in the matter of reducing time of transporting fresh fruits to Eastern markets, a very material reduction can be made in the time consumed in transit, as compared with the record of the past season."

As this conclusion by your committee appears to be based on the representation that this company has not made as good time west of Ogden as the lines east, we think it, in justice to all concerned, proper to state that the schedule *as agreed on for special trains of fruit in ventilated cars* for the fruit-shipping season of 1893 was—

45 hours from Sacramento to Ogden.  
51 hours from Ogden to Council Bluffs.  
24 hours from Council Bluffs to Chicago.

120 hours from Sacramento to Chicago.

Under this special schedule, which was the best that could be arranged, the Southern Pacific Company performed its part, the average time of its seventy-five special trains of ventilated fruit cars being 45 hours 20 minutes, which I think all will admit to be very close to the schedule for so long and difficult a run, so close as to cause no appreciable difference in time or handling of the trains.

We received from day to day from the Union Pacific Company a record of the time made on these trains after delivery to them; a few of the trains were omitted, unfortunately, but we have the record as furnished us by the Union Pacific for sixty-nine of these special trains, which shows the average time made, Ogden to Council Bluffs, to have been 62.68 hours. As reported by the Union Pacific, however, seven of these sixty-nine trains made such slow time, that for fear there may have been some inaccuracy in the report concerning them, we omit them; this leaves sixty-two trains, and on them the average time as reported by the Union Pacific was 59.42 hours. As the agreed schedule from Ogden to Council Bluffs was 51 hours, this shows the difference between the time actually made and the schedule agreed on was over 8 hours, which accounts for the embarrassing lateness of arrival at Chicago.

We make this correction merely to relieve ourselves of the misapprehension and prejudice that naturally result from a statement which charges this company with dereliction that is of serious importance to the growers and shippers of fruit.

We regard performance as of more real value to the grower and shipper than a promise of performance; it is easy to make a schedule, but it is not always so easy to run trains in accordance with the schedule. We are believers in making a schedule that can be run by, so as to give a uniform service on which our patrons can rely, rather than endeavor to fix the speed at so high a point that judging by the experience of the past it is not likely the schedule can be maintained with any fair degree of regularity. This is the view also held by the Rio Grande Western, Denver and Rio Grande, Colorado Midland, and Rock Island connections via Ogden, all also engaged in transporting green fruit during the deciduous fruit season, and I understand to be the practical view of our Union Pacific friends as well. A very fast time schedule looks very well on paper, but a more conservative schedule, carefully carried out, produces results of much more value to our patrons, whose interests in this respect we bear constantly in mind and shall be ever mindful of in the future.

Yours truly,

C. F. SMURR,  
General Freight Agent.

## DISCUSSION.

MR. BERWICK: I received these figures this morning. I did not have them yesterday. Perhaps some of you were here when I gave my paper yesterday. It was touching the government ownership of railroads. They are from a professor of economics. He is quite impartial in the matter. It is regarding the various countries which already own their railroads.

Germany has 26,627 miles of railroad, of which 13,057 are owned by the State and 293 miles are owned by private companies and also operated by the State. Expenses, 805,000,000 marks; receipts, 1,307,000,000 marks. That, you see, leaves a profit to the State of some 500,000,000 marks. The calculations are not made in this table. Regarding the profits of these railroads, I would say that they are almost all operated with a large profit to the State.

Austria-Hungary has 17,196 miles, somewhat more than half of which is owned and operated by the State. Expenses, 151,000,000 florins; receipts, 286,000,000 florins. There, again, is a profit of 135,000,000 florins; almost, I suppose, 90 per cent profit there.

Italy sold her railroads some years ago because hard pressed for money. She has to have a large army, or thinks she has, just now, in order to compete with the other countries surrounding her.

France: Railroads owned by private companies, but will revert to the State, without compensation, about 1950; that is fifty-seven years hence.

Belgium: The State owns 3,241 kilometers of railroads; private companies own 1,276 kilometers. In 1891 the gross receipts for the State amounted to 142,000,000 francs; expenses, 84,000,000 francs. There, again, was a profit of about 58,000,000 francs.

MR. ADAMS: Does that include the interest on the capital?

MR. BERWICK: I presume so. These are not my own figures; they are given to me by a professor of economics of California. These are his statements; they are to be taken for what they are worth. I can, no doubt, get these figures specified for you in a reasonable time.

New South Wales, 2,185 miles. Cost of construction and equipment to June 30, 1892, £33,000,000 sterling; gross earnings for last year, £3,000,000 sterling; working expenses, less than £2,000,000; that leaves £1,000,000, or \$5,000,000, profit to the government.

Street railways the property of the government: New Zealand, 679 miles of government railway in the north island, 1,170 miles in the middle island, and 142 miles of private lines. Expense of construction of all government lines, £15,497,700; operating expenses, £700,000; income, £1,115,481—a profit of about £400,000, or about \$2,000,000. In Queensland there were 2,304 miles of railway at the end of 1891, all owned by the government; cost of construction, £15,943,000; receipts, 1891, £974,705; operating expenses, £640,494; profit, £330,000, or \$1,650,000.

These are the figures I have. I will make no comment on them. You see, gentlemen, that governments can own and operate their railroads without losing money.



## REPORT ON CO-OPERATION.

The Secretary then read the report of the committee appointed to consider the question of coöperation in marketing fruit, as follows:

*To the Fruit Growers' Convention:*

Your committee appointed to consider the question of coöperative fruit marketing have had the subject under consideration and respectfully report as follows:

We are satisfied that the conditions which have already brought disaster upon some branches of the fruit industry of California will, if unchecked, speedily bring similar disaster upon all other branches.

We believe that the only remedy is that the growers shall themselves assume the marketing of their own product, and that the time has now come to apply that remedy.

We heartily approve and indorse the methods of coöperation already adopted by the citrus growers of Southern California, and the dried-fruit producers of Santa Clara County, which we find substantially alike in principle, differing only in detail to meet the different requirements of the dried and fresh-fruit trades.

We regard it of the utmost importance that the great coöperative movement now in progress should be so directed that all interests involved should work together, not only in harmony, but in actual consultation with each other.

To this end we strongly approve the movement originated by the State Horticultural Society for the organization of a State Fruit Exchange, and urge all individual growers and all coöperative societies to unite in its support, trusting to the combined judgment of all interests to direct its movements to the general good.

We especially urge the importance of a large attendance from all parts of the State at the meeting called by the State Horticultural Society for the 29th of December next for the purpose of settling and indorsing the plans for the exchange, awakening enthusiasm in its support, and selecting the men to carry it on for the first year.

I. H. THOMAS, Tulare County, Chairman,  
T. H. B. CHAMBLIN, Riverside County,  
D. T. FOWLER, Fresno County,  
EDWARD BERWICK, Monterey County,  
N. W. BLANCHARD, Ventura County,  
R. C. KELLS, Sutter County,  
H. A. BRAINARD, Santa Clara County,  
EDWARD F. ADAMS, Santa Cruz County,  
Committee.

Los Angeles, November 22, 1893.

On motion, the report was unanimously adopted.

## RESOLUTIONS.

## ON NATIONALIZATION OF RAILROADS AND NICARAGUA CANAL.

MR. BERWICK: It is necessary to know first what we want exactly—whether we want to have the railroads nationalized. I think we do want it. That is about the thing we want, and should want the most, just at present in politics. We waste our time and strength over what are comparatively unimportant issues. Here is an issue that comes home to every farmer right to his door, touches his pocket every year. We see other countries operating their railroads, owning them and conducting them successfully, and I think we are not asking too much of our Government to ask it to fall into line also. We adopted the Australian ballot law; we were not ashamed to undertake that. We might try the Australian railroad system with equal or more advantage; but I was hardly prepared to offer to-night any special resolution, though I have one drawn up to submit to the convention. When we are all agreed that we want this government ownership of railroads, we ought to think of some way to bring it about. Now, if we think this is right, gentlemen, I think we might each one of us, if we want this thing, take

a petition home to our neighbors, and get these petitions signed by every man and woman in his neighborhood. I am sure, in my vicinity, I could get every person to sign, and if this nation unanimously called for some action of this kind on the part of the Government, I am sure the Government would respond to the nation's call. So, if you will allow me, I will read the resolution.

*Resolved*, That this convention of horticulturists of the State of California, assembled at Los Angeles, this 22d day of November, 1893, believe that the best interests of California horticulturists and of the American nation would be subserved by the nationalization of the railways.

*Resolved*, That it believes that for such action there will never be any time better than the present. It therefore directs the Secretary of the State Board of Horticulture to memorialize Congress and every member thereof individually, and every United States Senator.

*Resolved*, That this convention considers that the interest of the whole Pacific Coast and of the entire American nation demands the immediate construction, by the United States Government, of the Nicaragua Canal.

Referred to Committee on Resolutions.

#### ON DEATH OF WM. T. COLEMAN.

On motion of MR. ROWLEY, the Chairman instructed the Committee on Resolutions to prepare suitable resolutions on the death of W. T. Coleman, of San Francisco.

#### ON THE PERKINS PROCESS.

The following resolution was offered by MR. E. W. MASLIN and referred to the Committee on Resolutions:

*Resolved*, That we have heard with great interest the system devised by Dr. Perkins, for the transportation of fruit, to secure its delivery without impairment of freshness, flavor, and appearance, and we hereby express our appreciation of the merits of the system, and this convention earnestly requests the several railroad companies to examine the system and to adjust their service cars to facilitate the experiment, believing that the system may prove an efficient means of securing a better market for our fruit.

On motion, duly seconded, the meeting adjourned until 9:30 o'clock to-morrow morning.

## XXIV.

## TRANSACTIONS OF THE THIRD DAY.

THURSDAY, November 23, 1893.

The meeting was called to order by Vice-President KINNEY.

THE CHAIRMAN: The first thing this morning will be resolutions from the Committee on Resolutions. The Secretary will read.

WHEREAS, It has pleased the Almighty to take from our midst one who has been identified, not only with the fruit growers' interests, but in all matters relating to the welfare of this coast; and whereas, by the death of the Hon. Wm. T. Coleman, California has lost one of its best and most prominent citizens; therefore,

Resolved, That we, the fruit growers of California, in convention assembled, tender our heartfelt sympathy and condolence to the family of the deceased.

Resolved, That a copy of these resolutions be sent to the family of the deceased, and published in the daily papers.

THE CHAIRMAN: The next business before the convention will be a presentation by Mr. Griffith.

## PRESENTATION TO THE STATE BOARD OF HORTICULTURE.

MR. GRIFFITH: Mr. Chairman, on behalf of the many fruit growers of Southern California, I take pleasure in presenting to the State Board of Horticulture this framed picture of Professor Koebele. It is but an humble token of our high regard for the untiring work of this Board in our interest. Besides, it is eminently proper to prove that, although absent, modest Mr. Koebele is not forgotten by the horticulturists in this part of the State, who believe him to be, considering his vocation and past efforts, the greatest genius of modern times.

THE CHAIRMAN: I will call on Mr. Lelong, Secretary of the State Board of Horticulture, to answer in response to Mr. Griffith's presentation.

MR. LELONG: Mr. Chairman, Ladies and Gentlemen, it gives me pleasure on behalf of the State Board of Horticulture, to accept the gift of the fruit growers of this part of the State—the framed picture of Albert Koebele. We recall that but four years ago the cottony cushion scale had invaded the orchards of our State, so that it threatened their very existence. At that time, all that could be done to subjugate this pest was done, but no effort that was made could keep it in subjection enough to warrant the pursuit of the citrus industry. Mr. Koebele was sent to Australia to discover, if possible, parasitic insects, and did discover the *Vedalia cardinalis*, which saved the citrus industry. Later on, the fruit growers of this State, appreciating the eminent services which they received through Mr. Koebele, presented to him a gold watch and chain; they also presented to Mrs. Koebele a beautiful set of diamond earrings. The history of that presentation will be found in the report for 1891. Later on, Mr. Koebele was again sent to Australia, where he discovered other beneficial insects, which will, I think, eventually prove of great benefit to California. Some of these are very promising, and only



require more time to establish their reputation as scale destroyers. Mr. Koebele is at present engaged by the Hawaiian Government, and will soon again visit Australia to search for parasitic insects, and he has promised to send to us those that he may there find. Therefore, we will receive from him further aid in that respect. I regret exceedingly that Hon. Ellwood Cooper, the President of the State Board of Horticulture, who would accept this gift on behalf of the State Board, is not present. He is very ill. He was taken ill yesterday, and will, perhaps, not be here until this afternoon. I thank you.

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### SUGGESTIONS ON HORTICULTURAL QUARANTINE.

By ALEXANDER CRAW, Quarantine Officer.

When the discovery of gold in California was heralded to the world, and the fortune-hunting pioneers were attracted to this coast in the hope of finding a short if not easy road to competence, there were many among them who left with regret the fruits of the old homestead, and some of these packed among their treasures seeds, pits, and plants of the choicest varieties of fruits common in their New England or Southern homes. These found their way to California, some across the plains, more across the isthmus. Preceding them, and the pioneers among the fruits of the Pacific Coast, were those introduced by the Mission Fathers. These all found their way into our State after a long journey by sea and land, and whatever pests they may have been originally infested with had succumbed to the long journey. This formed a natural quarantine against outside pests, and our early orchards were, so far as I have any authentic knowledge, absolutely free from all pests and diseases.

For many years the importation of trees and plants was expensive and hazardous, and but few and small lots were introduced.

The profits of fruit growing in pioneer times were very large, and this, in conjunction with the rapid growth, healthy appearance, and early fruiting of trees, induced several enterprising individuals to engage in the nursery business; healthy home-grown stock was produced to meet the demand, and for many years our fruits and orchards were free from destructive insects and fungous growths. Orchards were not numerous then, and were far apart, so that if a tree, or even an orchard, had been infested there was little danger of its infesting others.

With the advent of the railroad it was discovered that in California fruit growing was very profitable, and that the fruits grown here were superior to those produced elsewhere in the Union, and a natural impetus was given to this industry, which has steadily increased with expanding markets and more rapid, cheaper, and more extended facilities for transportation. A natural desire to obtain the best and the greatest number of varieties, on the part of the grower, led to competition among nurserymen to get what their customers demanded, or what would be acceptable to them. With rapid transportation the shipment of trees and plants from long distances has been made possible, and for years our State has been flooded with trees from every quarter of the globe, which were admitted without question, and with them came numberless pests and diseases which have annoyed our orchardists, entailed endless trouble and expense upon them, and very materially reduced their profits.

The planting of whole sections and whole counties contiguous to each other with orchards has facilitated the spread of these pests, and now makes transit easy from one orchard to another, from one county to another, until but a small portion of the State is free from their depredations, and the best methods of combating them is one of the most serious questions which we have to consider to-day. The destruction wrought by them soon forced itself upon the attention of our fruit growers, and the outgrowth of this was the organization of the State Board of Horticulture, with its Quarantine Officer, County Horticultural Commissioners, and Local Inspectors. The duties of these officers are twofold, preventive and curative, having in view the estoppel of the introduction of new pests, and the destruction of those which have already gained a foothold.

There is an old saying to the effect that "an ounce of prevention is worth a pound of cure," and it has proved so in this case; for, while we have expended enormous sums of money and endless labor in our contest with these tiny enemies, we have succeeded only in preventing their too rapid increase, and hardly that, and are far from exterminating them with all our labors, aided by all known artificial remedies; whereas, our preventive labors have been so effective that I believe but one new pest has found its way into our State since the passage and enforcement of our quarantine laws.

To you who know by hard experience what it means to have your orchards infested by destructive pests; who have seen your years of patient labor and waiting and investment in danger of being destroyed when the harvest should be ready; who have struggled incessantly year after year to get even a portion of your reward, while the rest is devoured by your millions or billions of insect foes that invade root, trunk, limb, branch, twig, leaf, and fruit, I need not enlarge upon the necessity of the strictest quarantine laws. There are yet numerous insect enemies and fungous diseases that we have not got and do not want. The peach yellows, which has devastated such large tracts in the peach regions of the East, reducing to a profitless waste what was once a remunerative country, has never yet obtained a footing in the peach orchards of our State. The plum curculio, which has rendered plum and cherry growing a total failure in many parts of the East, has never yet made his devastating presence known in our prune and plum and cherry orchards, and if he ever does, we may as well go out of that branch of horticulture.

We are now importing fruit, trees, shrubs, plants, and seeds from the East, from Europe, Australia, China, Japan, the South Sea Islands, South and Central America, and nearly all other countries; hardly a vessel arrives in our ports but brings some of these, and most of them are infested with some pest. On them are found scales, the eggs and pupæ of leaf-eating and boring beetles and moths, and various other forms of insect and fungous life, in most cases unaccompanied by the natural enemies which serve to keep them in check in the country of their origin.

It will be readily appreciated here that eternal vigilance is the price of success in the fruit industry, and if we would reap that just reward for which we labor, we must take effective measures to keep out those destructive agencies which we have not yet got, and stamp out by the best means those which we have.

This brings me directly to the question under consideration: "The

best means to secure effective quarantine against the introduction into the State of foreign tree pests and diseases." Under the Act organizing the State Board of Horticulture, it was required to make regulations for the purpose of preventing the spread of contagious diseases among fruit and fruit trees, and for the prevention, treatment, cure, and extirpation of fruit pests and diseases. In furtherance of this object the Board has formulated a set of regulations, the first one of which provides: "All consignees, agents, or other persons shall, within twenty-four hours, notify the Local Inspector or Quarantine Guardian of the arrival of any trees, plants, buds, seeds, pits, or cions at the first point of debarkation in the State of California."

To a violation of this regulation no penalty is attached, and it is therefore ineffective, and the only method of discovering importations of this character lies in the vigilance of the Local Inspectors.

Following the example of California, the Government of the Cape of Good Hope has passed a quarantine law giving the Governor power to provide by proclamation for protection against the importation and spread of pests, and providing a penalty for its contravention in a fine not exceeding £500, or \$2,500, with the alternative of imprisonment at hard labor not to exceed two years. It will be seen from this that the Cape Colony Government is fully alive to the necessity for stringent means to prevent the introduction of the enemies of the orchardist and vineyardist. I do not know whether our Legislature could delegate such powers to the Board of Horticulture, but there should be some measures by which the neglect or refusal on the part of importers or consignees of trees and plants to notify the Local Inspector of the district into which they are imported of their arrival, could be accompanied by a penalty. This would prove a most effective remedy against the surreptitious introduction of infested stock, and greatly lighten the labors of our Local Inspectors.

California was the first to recognize the necessity of protection against the introduction of insect enemies of the orchardist, and this necessity was forced upon us by the vast importance of the fruit industry, overshadowing any other industry in the State. Following our lead, the Cape Colony Government passed the law to which I have referred above, and the Governor, in pursuance of the powers vested in him thereunder, has formulated the following regulations, which bear date of March 8, 1893, and which are here reproduced, showing the stringency of the quarantine regulations of Cape Colony, and as containing some features which it would be well to copy in our own State:

#### IMPORT REGULATIONS.

I. The importation into this Colony, from places beyond the boundaries thereof, of all grapevines or cuttings, or portions of grapevines, is absolutely prohibited, with the exception of vines and portions thereof imported by the government of this Colony under such precautionary measures as it may decide to be necessary.

II. All trees and plants other than vines, and all tubers, roots, and bulbs, or any other portions thereof, may be introduced into this Colony from places beyond the boundaries thereof, provided each such consignment of trees, plants other than vines, tubers, roots, or bulbs, be accompanied by a sworn declaration from the consignor, certifying (1) that the articles proposed to be imported contain no vines or cuttings, or portions of vines; (2) that the said articles were grown at a distance of not less than 50 yards from any vines or roots of vines; (3) that no *Phylloxera* exists or has existed in the soil or in the neighborhood in which the said articles were grown; and (4) that the said articles are perfectly free from the pest known as *Phylloxera vastatrix*.

III. All packages, cases, pots, or coverings whatsoever, containing trees, plants, tubers, roots, or bulbs, shall, before landing, undergo a strict examination by a competent officer appointed for that purpose, to determine the absence of any vines, or portions of vines,



from the consignment, and, as far as possible, the absence of noxious insects and plant diseases hitherto unknown in this Colony. It shall be the duty of the consignee to open all such packages, cases, pots, or coverings, for the purpose of the examination aforesaid, and to afford every facility to the examining officer during his examination.

IV. On the examining officer being satisfied as to the absence of the *Phylloxera vastatrix* and of plant diseases hitherto unknown in this Colony, and, as to the sufficiency of the declaration in Section II above mentioned, he shall give a certificate to that effect to the consignee; and without such certificate no such articles shall be landed.

V. All trees, plants, tubers, roots, or bulbs which shall be found to be infected with the *Phylloxera vastatrix*, or any plant disease hitherto unknown in this Colony, shall be immediately destroyed.

VI. The Government does not hold itself liable for any loss or damage that may occur from the destruction of articles or from any process that may be considered necessary to discover the existence or otherwise of the *Phylloxera vastatrix* or any plant disease hitherto unknown in this Colony.

VII. The foregoing Import Regulations may, on application to the Secretary of Lands, Mines, and Agriculture, be relaxed so far as regards all trees and plants (other than grapevines) and tubers, roots, and bulbs destined for any area now proclaimed or that may hereafter be proclaimed to be an area infected with the *Phylloxera vastatrix*; provided, that all such trees, plants, tubers, roots, or bulbs shall with due dispatch be conveyed direct from the port of their destination in the infected area, and provided that they are free from any disease hitherto unknown in this Colony.

Another great assistance in the preventing of the introduction of foreign pests would be the erection of fumigating-houses at the different railroad depots, or at least at such of them as receive shipments of fruit, trees, and fruit packages. Here all infested stock could be treated at small comparative cost, and at much less labor than the same process now involves. In these houses should be provided all the necessary appliances for both fumigating and dipping, with facilities for retaining the infested stock until the Local Inspector is assured that it is clean from dangerous pests.

These measures, with the quarantine legislation we now have, would, if rigorously enforced, effectively prevent the importation of new plagues.

There is another point upon which I wish to touch in this connection. Some of our counties have passed quarantine ordinances designed for the protection of the counties in which they have been adopted. So far as these are supplemental to our State law, they are good, but as the State law covers the necessary ground, the inspector should operate under its provisions. No mistake can be made in this, for it has been passed upon in all its bearings by the courts, and declared constitutional. One of the severest tests of this law was in the trial of the so-called "Tahiti case," in which it was sought to destroy a large shipment of orange trees from Tahiti, infested with the mining scale, a pest not existing in California, and which, burrowing under the bark of the trees, it was not possible to reach either by dipping or fumigation. This case was brought in the name of the people and under the code to have the trees declared a nuisance and destroyed as such. After a hard-fought contest, in which the defendant importers were supported by the ablest counsel, Judge McKinley rendered a decision in favor of plaintiff, supporting its claims, and passing upon the validity of our quarantine law. I regret that the length of this opinion precludes my reproduction of it, but I quote some of the points of greatest importance to us who are interested in the protection of our great industry.

Among other things the Court declared:

"Every Judge is bound to know the history and the leading traits which enter into the history of the country where he presides. This we have held before, and it is also an admitted doctrine of the common law." (*Conger vs. Weaver*, 6 Cal. 548.)

The Court, therefore, takes judicial notice of the history, development, and character of the industries of California; of the fact that the production of fruits is one of the leading occupations in this State, and that a large portion of the people are dependent upon

it. It takes judicial notice of the fact that a large portion of the land in this and adjoining counties is devoted to the cultivation of citrus fruits, and that the annual production and shipment of oranges is very great, and that the spread of any insects injurious to citrus trees must necessarily result in serious injury to that business and in great loss and destruction to property.

That orchards and trees infested by scale or insect pests injurious to vegetation, and which will easily spread to other places, must be a nuisance *prima facie*, seems too clear to require discussion, and would not receive it at the hands of this Court but for the fact that this is the first case of this kind. \* \* \*

It appears to me that this case belongs to that class in which, if the allegations of the complaint are true, a damage will be inferred, and it is not necessary to wait until it is actually done. It is similar in that respect to the cases in which diseased animals are taken to public places when there is danger of infection, to the cases of the storing of explosives, and to the cases of condemnation of dangerous buildings and places likely to be injurious to the health of the community—in all of which the abatement of the nuisance rests merely upon the reasonable apprehension of danger. The fact that the trees are at San Pedro does not prevent their being considered an existing nuisance, as the evidence shows that the larvæ of the scale may be carried by birds, insects, and the wind to distant portions of the county and State. \* \* \*

The defense claims that the trees should be separated and only those upon which the scale are found be destroyed. There is no doubt that the position of the defendants is correct; that in abating a nuisance no more property should be destroyed than is absolutely necessary for that purpose. But in this case the situation of these trees is such that there is no certainty that all are not infected, and if such separation can be made it should be done by defendants. \* \* \*

From the evidence of the experts, and in the absence of any suggestion of a method by which the trees can be disinfected, the Court must conclude that it cannot be done without the destruction of the trees.

It therefore follows that the allegations of the complaint are sustained by the evidence. The Court is of the opinion that the statute of March 19, 1891, is constitutional, and that even in the absence of such a statute, the trees in question are a nuisance under the code, and that plaintiff is entitled to the relief demanded in the complaint.

Let findings and judgment be submitted in accordance with this opinion.

It would be well if we could secure the passage of a Federal quarantine law, and this measure is one that our fruit growers should labor for. We have general quarantine laws against infectious diseases, laws to prevent the landing of criminals, paupers, or other undesirable classes; we have a protective tariff to prevent the competition of foreign fruits with our own, but nothing to prevent the introduction of the greatest evil of all—destructive insects, pests, and diseases.

It is the little things in life which do the most damage; we can conquer the lion in our path, but the gnats overcome us, and so it is with the evils I have alluded to. Paupers and criminals, whom we exclude, would die out in a generation or two, contagious diseases would become eradicated, but these insignificant pests, many of them microscopic in size, once introduced are with us forever; they increase with alarming rapidity, and spread over the land with every breeze that blows, are carried by the birds and flying insects from section to section, and the ponderous power of man is futile against their depredations. What the exact extent of these depredations is cannot be told, but it extends into the millions of dollars. Wisdom requires, then, that both in State and nation we should take every precautionary measure possible to prevent the introduction of new troubles, to add to those which we already bear at such tremendous cost. I would therefore urge that our Congressmen be requested to use their efforts in framing and passing a general quarantine law, which, with our State laws and county ordinances, should effectually bar the entrance of new pests, and leave us to work out the problem of getting rid of those we already have.



## DISCUSSION ON HORTICULTURAL QUARANTINE AND BENEFICIAL INSECTS.

PROFESSOR HILGARD: Mr. Chairman, the paper just read has such an evidence of truth on its face that I hardly think it worth while to discuss the nature of the measure proposed. That the State must protect itself, is clearly evident. The most important point, and the only point, is that the United States shall take a hand in this legislation. I regard here, that the regulation of interstate commerce covers also protection to the State, and United States legislation can regulate importation of fruit stock just as well as it can regulate the importation of anything else by interstate commerce. I think the suggestion of Mr. Craw a most timely one in regard to protection against some of these diseases. It is, perhaps, reasonable to afford a little consolation to our fruit growers by saying that some diseases that have been introduced were not able to propagate themselves in this climate.

MR. SPRAGUE: Mr. President, I doubt not that we are all agreed upon the exceeding importance of the recommendations of the paper; but there are some considerations which perhaps these introduce to our minds. First, it is desirable, of course, to make the law effective. A law without a penalty is very difficult to enforce, and hence this recommendation by the writer of the paper is evidently a judicious one. But on the other hand, it necessarily should be so shaped that the proprietor of the stock should be protected, so far as possible, from injury. Of course, the enforcement of any such law as this—the law of inspection and quarantine—over so large an area, and by so many different officers, is productive of a great deal of irritation. Very much of that irritation is due to the personality of the officers who are endeavoring to enforce it. They are indifferent, perhaps, to the rights of those concerned in the matter. The difficulty of securing the coöperation of the people interested is due largely to that one consideration, that they are not sure that they will not be subjected to the grossest injustice by the official whose duty it is to interpret the law and execute it. There are cases within our own personal knowledge, where large quantities of trees—and I do not refer now to the tree case in which I may have been somewhat interested, but to other cases in which large numbers of trees have suffered very serious and very unnecessary injury from the indifference of inefficient local officers. Now, I say that whatever resolutions are adopted in the convention, looking toward the enforcement of the law, or to the amendment of the law, making it more efficient, it is very desirable that in whatever is adopted there be an assurance to the owner of the property that he will not be needlessly damaged by the fruit men. I should be very glad, indeed, to see the closing recommendation of the report adopted. I think it would result in very great good to the people of California and to the people of the whole United States.

MR. BERRY: Mr. President, I am engaged in several industries in Tulare County. I am also the County Horticultural Commissioner of that county, and my duties are such that it takes me all over that county, and brings me directly in contact with the fruit growers, and my observation and experience in reference to these insects pests throughout the State perhaps will interest you. Some three or four years ago in Tulare County, the pernicious scale seemed to take possession of the county. There had been nothing done whatever to hold it



in check at that time. It was called the San José scale, because it was said it had been introduced on trees brought from San José, and San José got the reputation of introducing the scale into Tulare County. It became so bad, without any attention being given to it, that those gentlemen who were engaged in the industry of fruit growing in Tulare County were about to become bankrupt, in consequence of the poor quality of fruit they were producing. It seemed to attack all kinds of deciduous fruits. At the suggestion of Mr. I. H. Thomas, a composition of sulphur, lime, and salt began to be used throughout that county, and to a great extent it kept that scale in subjection. But it did not eradicate it, and it cost a large amount of money to even hold it in subjection. That money the fruit growers had to put up. The remedy was a good thing when properly applied, but the trouble has been—and I have found it to be so and believe I voice the sentiments of those who have come in contact with the fruit growers—that the difficulty of instructing the operator how to prepare the material and apply it is very great. You may stand over your boiler and boil the material for him and instruct him with the utmost care how to apply this preparation, and he will come back to you and say to you that your stuff is no good. He insists that he put it on just as you told him to, but you know that he has not done it right, because, if he had, he would have had the benefit of it. So that in my experience, when we were attacked by one of these insects that destroys all fruit trees, it was necessary to use some sprays and washes, until we can find some other remedy. In Tulare County last year there was known to be in large sections of certain localities, several species of beneficial insects which cleaned the orchards of scale. We certainly thank some one for the benefit we have derived from the introduction of these parasites. It was decided at the meeting of horticulturists of Tulare County last year, that to continue spraying would destroy our fruit, which would be more beneficial to us than destroying a part of the scale. It was thought to be a good business proposition to abstain from spraying. The result has been that these parasites have spread over our county, until we have hardly any pernicious scale at all. Certainly the orchards are benefited by the introduction of these parasitic insects.

But now we are engaged in the industry of growing citrus fruits, and we are scared to death on account of the red scale which exists in Southern California. I must confess we are very much frightened. Along comes a box of oranges out of this section and they are covered with red scale. We sit down on the oranges and throw them out, but that does not keep the scale from coming into our county. No matter how strict the railroads are, we cannot prevent a passenger coming into our county and peeling an orange and throwing away the skin where it will come in contact with the trees, and the scale will be left. Really, I see no way how the quarantine laws are to prevent the spread of these pernicious insects. They have cost every fruit grower and every nursery man in the State hundreds of thousands of dollars to keep them in subjection, and the best remedy that they have had thus far has been the introduction of parasitic insects.

I believe, gentlemen of this convention, that if our State Board of Horticulture use their efforts and make some failures in regard to not introducing the parasitic insects that will accomplish everything at once, it is no reason why the fruit grower of the State of California should

say they are delinquent in their duty, when they are making the effort to introduce all good parasitic insects.

I stand here to-day as a representative of the fruit growers of Tulare County, and my observation as such, in the State of California, leads me to make this statement—I stand on this ground, that the only cure is something in nature better than that which man invents. Now, I consider it a good thing, when we have not discovered something in the shape of these insects to help us out, to keep up our spraying. I believe if you will pay more attention to the laws that govern nature in the introduction of such insects, that it will cost less money to find something of that kind than it will to keep up your sprays on the trees all over the country. I defy any one to apply sulphur for less than \$10 to \$12 an acre, which is for the application of something which does not kill that pernicious scale. It only kills part of it, and next year you have to do it over again. By the introduction of the ladybirds and other scale-destroying insects, while you are asleep, while it rains, while the sun shines, they are performing the work for you, actually performing labor that it would cost you a great deal to perform, and that you do not accomplish successfully by spraying.

In regard to the red spider. As you in the San Joaquin Valley already know, this is going to be a very serious thing to us. Some day many people in our valley will not raise lemons at all. When you think that every pair of them hatches out 300,000 more, and that each pair of this 300,000 hatches out 300,000 more, you can understand how rapidly they will multiply. We are fighting them with a spray. The last man that comes along with a preparation we buy that. It does partial good, but you have to go on with your spray and continually apply it, or otherwise you do not accomplish anything. We found that sulphur was the best of all, and now we apply sulphur, and it is a very good remedy. But I believe that sulphur will have to be applied every year. How much better it would be to introduce a parasitic insect, and eat up the red spider and do away with it at once.

While I am on the floor, I want to bring up a subject that pertains to these insect pests of California; and while it has not been mentioned by Mr. Crow, a gentleman I have a great deal of respect for, it has agitated us. It is root knot. I know we are going to have a lot of theories in regard to root knot, but I stand in such a state of confusion that I have no theories left. We have talked to our scientists, we have had professors of entomology to visit us, we have partaken of their knowledge, and it has amounted to nothing. We have tried experiments of our own, and they amount to nothing. We are at sea; we recognize it, but the destruction is going on all the time. Peach trees in the orchards in our valley have been blown over right at the ground. No man can afford to raise fruit and have his trees destroyed in five or six years. There is one orchard in our district, consisting of 11,000 trees, which is now eight years old, and prune trees bear in our county in the third year. These trees are now eight years old and they have never paid the cost of cultivation. They have been destroyed by the root knot. They are all destroyed, comparatively speaking, as far as their productiveness is concerned.

MR. SPRAGUE: Have you found any cases, where the trees were planted entirely free from any suspicion of root knot, that afterwards developed it—after the trees were planted?

MR. BERRY: Yes, sir.

MR. SPRAGUE: Do you throw out the whole consignment of trees if you find a tree or two affected with root knot?

MR. BERRY: I will explain that to you. We found in some instances where nurseries had been affected with this knot and the knot had grown partly out on the root of the tree, that after that part of the root had been cut off by a clean cut, the disease was still left and those trees developed the root knot after they were planted. I will give you an experiment which I tried last year. I planted ninety trees that had the knot on. Before planting, I carefully removed the knot. I used a fungicide on the wound made by removing the knot. I carefully took clean, healthy bark from clean, healthy tree roots, and carefully grafted the bark on these roots where this knot had been removed, where the wound had been, and I carefully planted those trees. They grew very nicely, and as nicely as any other trees. When Professor Woodworth, from Berkeley, was down in Tulare County, we took those trees up, and on every one of them the knot had oozed out at the crack where the joining was made between the section broken and the new bark, and it was just one mass of small knots. This indicated to me that the disease was in the sap of the trees. Along came another man, and he said that this was in consequence of irrigation. We do not irrigate. How do you account for that? Another man says it is a bug; another man says it is a worm. And so it goes on, one has one theory and one has another; but one thing we do know, and that is that in the orchards where it is it has seriously injured our trees. Now, we are going to be affected by the codlin moth. Tulare County has the reputation of raising some of the finest apples in the State. Yet the codlin moth is going to destroy them. The pears are affected by it. Now, if we can introduce, through the State Board of Horticulture, or by any gentleman employed by them, anything that will be of as much benefit to the growers of the apple and the pear as the parasitic insect that has destroyed the cottony cushion scale, I say, on the part of the gentlemen belonging to this Fruit Growers' Convention of California, it behooves them to take action, and to urge free and continuous action in that direction, to bring other insects here into California [applause]; and I hope that this convention will, before it adjourns, by a series of resolutions, adopt something of that kind, urging it strongly upon our State Board to pursue their experiments in that direction. [Applause.]

JUDGE HEATH, of Santa Barbara: Mr. Chairman, I have, in connection with this matter, a resolution which I desire to introduce, and will ask Dr. Perkins to read it.

DR. PERKINS then read the following resolution:

WHEREAS, It is now apparent that the best method of overcoming the various insects, such as scale and others, so detrimental to horticulture, is by the introduction of parasites; and whereas, the efforts of the State Board of Horticulture, in the introduction of such parasites from foreign countries, have been eminently successful; therefore,

*Resolved*, That it is the wish of the convention that the Board should continue its experiments in this line, and that it should receive the support of all those so intimately connected with the prosperity of horticulture. To this end the convention earnestly requests the Legislature, at its next session, to appropriate a sufficient sum of money, not less than \$10,000, to be expended in the discovery and importation of insects beneficial to horticulture in this State, and that the Legislature provide that the importation and culture of such insects, and the expenditure of such sum of money, be voted to the care of the State Board of Horticulture.



JUDGE HEATH: I wish to say, Mr. President, that among the fruit growers of California (and I have been one, that is to say, interested in the fruit industry, since 1859) I have seen the necessity of keeping our orchards free from pests, particularly the citrus fruits in my location. The other fruits are not affected, but the citrus fruits are. We have been to great disadvantage in spraying and watering the trees. It is almost impossible to eradicate the pests from large trees. I have lemon trees twenty-seven years old, and to fumigate such trees I might as well cut them down as far as profit is concerned. With a tree of that kind it is almost impossible. Now, in later years many orchardists are setting out different varieties of citrus fruit, and we have a pest in Southern California which has cost us thousands upon thousands of dollars, and we are not getting rid of the pests yet. But within a few years, and with the aid of the State Board of Horticulture, we have succeeded in getting an insect which is materially aiding in exterminating the bug on our deteriorating fruits. We had an appropriation from this State, and through the State Board of Horticulture an officer was sent by the United States Government to import the bugs from Australia. The last Legislature, unfortunately, made no appropriation, and we simply have the insects that were given us before. My desire in introducing this resolution is to lay the foundation for another appropriation to uphold the hands of our State Board in their energies and efforts to rid the State of other pests. I recognize that Southern California is to be the great fruit belt of the United States, and we must, of necessity, protect our orchards, or our energies will necessarily fail. The State has authorized the State Board of Horticulture to go ahead. Now, let us come in and act with that head, and let us uphold the State Board and its agents, and let us save our orchards and furnish the world with the best fruit that can be raised. [Applause.]

MR. COLLINS: Mr. Chairman, I move to strike out two words in that resolution; that is, "eminently successful," in the preamble.

JUDGE HEATH: Well, sir, perhaps I have drawn that a little too high. I say eminently successful on this ground: The few insects that we have been able to get from Australia—we know that the cottony cushion scale has almost entirely been eradicated; we know that the black scale has now disappeared in many orchards. I know that from experience in my orchards and the orchards of my neighbors. While the time has not arrived when all the insects are destroyed through any process of destroying, I think if we will give them time they will be entirely destroyed. I do not stand upon one or two words, but I do not think that those words ought to be stricken out. If the convention thinks proper, all right, I am satisfied. If the State Board of Horticulture, whose energies are spent in this respect, are assisted; if our Legislature will give us the paltry sum of \$10,000 in the interest of the orchards—I say we ought to ask for more money, but we are willing to take the paltry sum of \$10,000. I say the time is coming, and it is not far distant, when California will be entirely rid of these pests by the action of the State Board of Horticulture in this matter.

MR. ADAMS: Mr. Chairman, I want to ask how much it has been estimated has been saved the State, in money value, by these insects which have proved successful?

MR. BERRY: It is incomputable.

MR. ADAMS: One hundred thousand dollars? One million dollars?

MR. BERRY: Yes; several million dollars.

MR. ADAMS: If this is the case we might call it eminently successful.

MR. CHAPMAN: Mr. Chairman, I would like to say that as far as my ranch is concerned, if it had not been for the *Vedalia cardinalis* I would not have had any oranges at all. For the past season I have been able to pay the railroad company \$250 per acre for freight, simply by the introduction of this parasite.

MR. BERWICK: Ten thousand dollars may be a paltry sum, but it would not be to me. The last expedition cost, I believe, \$3,700. Why should the next expedition cost more? We might get \$3,700 from the Legislature; we might not get \$10,000. I believe in using public money as if it were our own private money, and not asking for more than we want.

MR. MASLIN: Mr. President, appropriations are generally made for two years. Do not let us ask for that which we can get, but for that which is sufficient. The essential thing is that this convention appreciate the efforts of the State Board of Horticulture. When it comes before the Legislature that body will inquire into the operation of the law, and how much can be or will be needed. We probably cannot get \$10,000, but it is well enough to put it in.

JUDGE HEATH: I want to say that the reason for putting in the sum of \$10,000 was that I have been in the Legislature and represented my county various times. These appropriations are made for two years, as our Legislature meets once in two years, so that the \$10,000 being voted, it would be \$5,000 per year. Now, it is true that with the appropriation of \$5,000 some years ago, some insects were introduced that proved of great benefit to the fruit growers of this State. It was a new thing, gentlemen; we were struggling against what we supposed to be fate. Many orchards in this State have been entirely killed. You need not go far from the City of Los Angeles, right now, where the orchards were prosperous, to find where they have been almost entirely a failure. The State is losing nothing by an appropriation of \$10,000, and I want to say that when I was in the Legislature of this State, and asked for an appropriation on such grounds, I have never been refused. The great heart of California will never refuse Southern California \$10,000 to increase the State's value for business purposes \$2,000,000.

MR. BOYD: I move that the resolutions be referred to the Committee on Resolutions.

MR. MASLIN: I would like to amend by instructing the committee to report this afternoon.

MR. BOYD: I accept the amendment.

Adopted.

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#### CLAIM OF YOUNG & POWERS.

MR. YOUNG, of the firm of Young & Powers, attorneys, was permitted to address the convention as to a bill due them from the State Association of County Horticultural Commissioners.

MR. STABLER: Mr. President, it may be proper, at this time, for me to say a few words supplementary to what Mr. Young has said, as I have followed this matter very closely and am now Secretary of the State Association of the Commissioners. I think it very proper to bring the

matter up at this time. Four years ago, when a Fruit Growers' Convention was held at Los Angeles, this matter of trying to pay this bill was first agitated, and the County Horticultural Commissioners started in to draft a bill. At the next convention, at Santa Cruz, a year later, or three years ago, the matter was brought up again. A committee from the Fruit Growers' Convention and Convention of County Horticultural Commissioners joined, and they drafted a bill, and a committee from the Fruit Growers' Convention, consisting of two attorneys, thought the bill was not constitutional. It was decided that the bill was not properly drawn and it was necessary to have the bill drawn by a regular attorney. At that time a committee was appointed by the fruit growers here to appoint an attorney to draft the bill, and go to the Legislature and try, if possible, to secure its passage. I would state further, that a committee of the State Fruit Growers was appointed for that purpose. That bill was given into my charge to introduce, and Senator McComas of Los Angeles introduced the bill into the Senate. It was very necessary to have the assistance of the attorneys at that time, from the fact that on a second reading the bill was amended, generally by members from mining and stock counties, who had no interest in the matter and yet had certain amendments they desired to insert—amendments which would have killed the bill. Mr. Young on several occasions came up and appeared before the committee and asked for the passing of that bill. The horticultural committee of that Assembly was not in favor of passing the bill. It was pretty hard to get the horticultural committee to report the bill back to the house, but we got it reported. A committee from the fruit growers stayed there and watched that bill and worked hard. In the case which was tried in this vicinity, in which over a quarter of a million trees infested with orange scale were treated under this measure, Judge McKinley, of Los Angeles, held the bill to be entirely constitutional. What I wish to say is this: It required, of course, an expense in this matter. The committee of fruit growers guaranteed \$500 if they would go up there and secure the passage of the measure—Powers & Young were guaranteed \$500 if they would act as attorneys in this matter. They have not been paid. At the Marysville convention this matter was brought up as it has been to-day. It was indorsed by the convention. Gentlemen from all over the State pledged themselves to raise certain sums of money and help defray the expense. They have not done it. There is still due \$500. At the San José convention, although I was not present, I know that this matter was brought up, indorsed by the convention, and the amount pledged throughout the house. The members who pledged themselves were members of the State Horticultural Commissioners. That is certainly a complete indorsement of this measure, and we feel that it is due that some action should be taken. Now, the attorneys in this matter have taken some action. They have served me and other gentlemen with summons and complaint. We would like to see this convention take some action and settle this matter.

MR. SPRAGUE: Mr. Chairman, I recognize fully that the sentiment of this convention is in favor of the motion which it is decided to put before the convention for the payment of this money; but, sir, I beg your indulgence, while I make a protest against such action. It is not that we do not appreciate in the highest degree the intention of this resolution, but it is, sir, that the whole matter of bringing it before this convention



and soliciting the payment of this money by this convention for services that are not directly traceable to the demand of this convention, is entirely wrong, sir. It is a most dangerous precedent. What do we see? We see the members of the Legislature of the State of California entirely ignored as to their ability to prepare matter for legislation, to see that it goes properly through the several committees and is laid before the Assembly. Is it presumed that there is not sufficient ability among the Legislature of California? Do you from Southern California send no men there who themselves understand the proper preparation of legislation? The thing is absurd. I challenge you to find any such precedent in any other State of the Union. It is entirely wrong and a most dangerous precedent. The payment of a lobby to go to Sacramento to see that a certain bill, which is absolutely necessary to the existence of horticulture in this State, goes through. It is, then, ridiculous, and if we put ourselves on record in paying for this kind of service, we, ourselves, join in the complicity.

MR. ADAMS: I have always felt that the proposition that the State horticulturists should pay this bill, which has been brought up in the various conventions, was wrong. Gentlemen, I have changed my mind. I am satisfied that it is exactly right. I am satisfied that it was not improper. I am satisfied that it was necessary. I am satisfied that the indebtedness was incurred with a full pledge, so far as any of these conventions can pledge the horticulturists of the State to stand by anything; and I say, if the horticulturists of the State do not stand by the committee appointed to help them, and which did labor for them to the best of their ability, it is a shame. [Applause.]

MR. SPRAGUE: If it is true, as this gentleman states, that this was done at the command of this convention in previous assembly, then I withdraw all objections.

MR. LELONG: I can explain something about this bill and stop the discussion, and get some money. At the time this came up in the convention at Marysville, different representatives of different counties were asked if they would guarantee certain amounts in their counties. Some said they would. Afterwards a list of counties was brought in and they were asked if the amounts had been collected. Some replied that they had paid, and others were not paid. If Mr. Stabler will present that list, and if those people will rise and say whether they have collected in their county, it would settle the question.

MR. COLLINS, of Ontario: As Mr. Lelong has said, the question is how to raise this money. San Bernardino County was assessed \$70. We have paid \$189. Now, if the other counties will come forward and do something like that this question can be dismissed in a few minutes.

Action on this matter was postponed.

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### THE OLIVE WITHOUT IRRIGATION.

MR. CALKINS, of Pomona: Mr. Chairman, I have here a sample of olives grown without irrigation, which I would like to show to prove that in some localities it may be done without irrigation. They were grown north of Pomona, above our water line, and have never had any water.

QUESTION: What is your average rainfall?

MR. CALKINS: The rainfall for the past five years has been between 8 and 20 inches.

MR. BERWICK: What was the crop to the tree?

MR. CALKINS: There are about four hundred trees, and there were about ten tons last year.

QUESTION: How old are the trees?

MR. CALKINS: They were part of them five, and part of them six years old.

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### RESOLUTIONS.

MR. SNOW, of Orange: Mr. Chairman, I have a resolution I wish to offer, relating to attacks made on the State Board of Horticulture.

THE CHAIRMAN: If you have no objection it is referred to the Committee on Resolutions.

The meeting then adjourned till 1:30 this afternoon.

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### XXV.

### AFTERNOON SESSION.

Vice-President KINNEY in the chair.

The convention was called to order at 1:30 P. M.

THE CHAIRMAN: The first business of the convention this afternoon will be the report of the Committee on Resolutions.

MR. GRIFFITHS, Chairman of the Committee on Resolutions, reported that four out of the five members of the committee, the fifth member being absent, were unanimously in favor of the resolution introduced by Judge Heath at the morning session, which had been read to the convention, and he moved, as the sentiment of the committee, that the resolution be adopted.

This motion was seconded, and on being put to a vote, was unanimously carried.

MR. GRIFFITHS: As to the second resolution, introduced by Mr. Snow, the committee beg to say that they are not quite ready; they have not yet been able to get together, and would like to keep that resolution until to-night.

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### FRUITS AND SOILS OF THE ARID REGIONS.

By PROFESSOR E. W. HILGARD, of Berkeley.

I wish to call the attention of the convention to some points in the researches of the California Experiment Station, and particularly in regard to some very striking differences between the results of investigation in California, and in Europe and the East. It is often attempted to apply European and Eastern experience and data to Californian practice. I desire to show what I observed in beginning the work of the

station seven years ago, namely: that the difference in the nature of soil and products is so great that we must be extremely cautious how we attempt to apply Eastern practice to this country. We apply to the countries where the rainfall is deficient, or falls in only one season of the year, the term "arid regions," without intending to cast any reflection upon those regions, while the other portion of the country—Europe and the country east of the Mississippi—is called the "humid regions."

One point I wish to call attention to in the beginning is the historical fact, which may or may not have struck some of you before; namely, that the oldest civilizations of the earth developed in the arid region. Where do we have the oldest civilization? In India, Persia, Egypt, in the old continent; and the highest civilization was developed on this continent, as far as we know, on the plateau of Mexico, and in Chile and Peru—arid lands in every sense of the word, regions of deficient rainfall, with all its consequences. It has often been asked why these nations chose for their development the region that seems to offer so little inducement. It does seem that we ought to prefer to live where nature does the irrigation for us, and it seems rather an incomprehensible selection that these ancient nations have made, particularly as regards Egypt more than India. True, in India there is a humid and an arid region, but the arid region is the one that has reached the highest grade of civilization—the northern portion of India, which embraces the most celebrated cities and regions of Indian history and mythology.

I think the table before you helps somewhat to solve the question. This table is based on results of about one thousand analyses of soils, which have been made largely under my direction, and precisely by the same methods throughout.



Average Composition of Soils in the Humid and Arid Regions of the United States.

Name of State.	No. of Soils Averaged....	Insoluble Residue.....	Soluble Silica.....	Total Insoluble Residue and Soluble Silica.....	Potash.....	Soda.....	Lime.....	Magnesia.....	Brown Oxide Manganese.....	Peroxide of Iron.....	Alumina.....	Phosphoric Acid.....	Sulphuric Acid.....	Water and Organic Matter.....	Total.....	Hygroscopic Moisture....	Temperature of Absorption, C.....	Soluble Phosphoric Acid.....	Humus.....	Carbonic Acid.....	Available Inorganic Matter.....
North Carolina.....	20	81.627	3.505	85.133	145	.057	.088	.080	.071	4.718	5.713	.118	.061	3.977	100.163	4.982	21.1	---	---	---	---
South Carolina.....	11	83.493	3.425	86.919	123	.039	.114	.155	.083	2.771	3.709	.097	.108	3.899	100.039	4.298	23.6	---	---	---	---
Georgia.....	40	86.006	2.887	88.954	150	.065	.076	.099	.090	2.751	4.018	.111	.086	3.919	100.029	3.543	17.4	---	4.383	---	---
Florida.....	7	94.277	1.172	96.449	101	.034	.081	.057	.077	3.814	1.169	.091	.069	2.274	100.136	2.904	24.4	---	---	---	---
Alabama.....	50	81.576	4.893	86.469	251	.073	.169	.210	.120	3.814	2.699	.134	.069	3.831	100.011	7.066	20.2	---	---	---	---
Mississippi.....	97	85.870	4.391	89.714	276	.109	.145	.312	.157	2.643	4.069	.091	.029	3.704	100.176	5.419	15.4	---	.680	---	---
Arkansas.....	38	---	---	88.539	165	.056	.081	.430	.205	3.039	3.511	.150	.045	3.691	99.931	2.479	---	---	---	---	---
Kentucky.....	185	---	---	86.719	199	.104	.081	.193	.197	6.008	3.523	.109	.038	3.691	100.862	1.845	---	---	---	---	---
Louisiana.....	18	78.393	6.837	85.231	290	.086	.163	.379	.153	4.543	5.667	.129	.057	3.644	100.261	6.656	24.5	---	---	---	---
Total for humid region. Averages by States.....	466	84.031	4.212	87.687	216	.091	.108	.225	.133	3.131	4.296	.113	.052	3.644	100.178	4.650	18.5	---	2.39	---	---
California.....	198	67.882	8.960	76.842	644	.277	1.075	1.488	.062	6.303	8.721	.083	.048	4.396	100.048	5.925	---	.03	1.040	1.148	.48
Washington.....	76	75.021	3.673	78.696	777	.249	1.378	1.171	.049	5.530	6.063	.173	.028	5.226	99.952	3.941	---	---	1.135	.403	4.67
Montana.....	39	66.141	6.235	72.376	1,005	.226	2.483	1.494	.057	4.459	7.145	.178	.029	7.133	99.955	8.712	---	---	3.321	2.398	1.82
Total for arid region. Averages by States.....	313	70.565	7.266	76.135	729	.264	1.362	1.411	.059	5.752	7.888	.117	.041	4.945	99.993	6.281	---	---	1.839	1.316	3.32
Utah.....	1	79.20	4.70	83.90	709	.404	1.237	.848	.019	7.770	1.477	.160	.003	3.707	100.232	6.859	---	---	1.830	1.316	2.32
New Mexico.....	1	63.20	7.32	70.52	732	.176	*10.060	1.007	.020	4.031	2.560	.103	.082	3.197	99.849	---	---	---	---	---	---
Colorado.....	1	69.61	11.12	80.73	964	.113	.706	.845	.006	6.640	5.560	.090	.033	4.430	100.117	---	---	---	---	---	---
Average of the three.....	---	70.67	7.71	78.38	801	.231	.971	.900	.015	6.147	3.199	.117	.039	3.778	100.099	---	---	---	---	---	---
Wyoming.....	9	75.79	2.45	78.24	72	.47	2.67	1.45	---	3.32	5.85	.18	.10	4.79	99.69	---	---	---	---	1.90	---

\*Omitted in the average.

I should here say that if you have any special soil and analyze it by two or three different methods, you can get as many different results, and results which contradict each other; so that unless the investigations are made in every case in precisely the same manner, no comparison is possible. That is the reason why, notwithstanding a large number of such analyses have been made heretofore, this is the largest existing set of analyses of soils that are strictly comparable. These comparisons there can be no question about, and I will call your attention at the present time to the extraordinary coincidences from distant regions.

The data of the upper portion of the table, in the humid region, were obtained largely in connection with the census of 1880, when I was in charge of the work on cotton production in the Southern States. You see, the States mentioned there are the Cotton States. I resided there for eighteen years, and therefore was able to accumulate a large amount of information in regard to the climatic conditions of that country. The analyses of Mississippi, Louisiana, and Alabama were made directly under my own supervision, and others under my general orders.

Now, I wish to call attention, in this table, mainly to the substances which have been marked in red. They are phosphoric acid, lime, and potash. The amounts found in the soils have been averaged, and you see the total averages of the same in four hundred and sixty-four analyses from the humid region of the United States. If you look through the averages for the several States, you will find in these columns remarkable coincidences throughout. They do not differ in the general averages of the same substances in any material degree. For instance, the humid regions for potash, you will have an average of about 0.22 per cent. There are, of course, soils of the humid region which reach above that. For lime, the average is about 0.11, or one tenth of one per cent.

Now, stop a minute with these two exceedingly important substances. Come down to the averages for the arid region, and you observe how widely the figures for the arid regions differ from those of the humid region. Making an average of the whole number of 319 analyses, we have for potash, instead of 0.22 per cent, about 0.8 per cent, approximately three times more than the humid region. For lime, we have from twelve to fourteen times more.

We may average these analyses by States, by averaging the figures for each of the States represented—that is a mode of looking at it, which is justified by the facts, as the analyses of these soils were made with a view of being representative of the States from which they were taken. The samples from Florida were taken so nearly representatively, that later analyses made by the chemist of that State do not vary to any material extent, the average remaining the same as here shown. Reckoning, therefore, in two ways—by the whole number of analyses, or by averages of States—you observe that whichever way you take, the same result comes out. The figures are slightly changed, but the general result is the same. In the humid region the result for potash is about one third; in lime, it is approximately the same as before—twelve to fourteen times as much lime in the arid region as in the humid region.

The absolute amount of lime in the arid region is about as much as is ever of any use. As a rule, more lime would be perfectly useless in the soils of the arid regions, for they average as much as  $1\frac{1}{2}$  per cent. That has been shown by experimental tests at the Experiment Station,

and in private experience, over and over again. In consequence of this heavy proportion of lime, the addition of lime to our soils is useless. Only when the soils are very heavy, it may be desirable to apply a dressing of lime.

The same naturally applies in a measure to potash, the other substance which in the humid region, as well as lime, has been found exceedingly efficient as a fertilizer. Lime is, as all of you know who come from the other side of the mountains, an exceedingly common and effective means of improving the land; it has been tried over and over again in this State, both at our stations and by private parties, and unless the lime that was used contained other substances, the result has been practically *nil*. What applies to lime would naturally be supposed to apply also to potash, while soils are fresh.

As to phosphoric acid, there is no material difference between the humid region and the arid region.

The average for the arid region (embracing California, Washington, and Montana) and for the humid region are practically identical.

Now, let us see why this difference should be. As to potash, it is perfectly evident what it comes from, because the combinations of potash, the sulphate, muriate, and caustic, and carbonate of potash, the usual forms, are all soluble in water. In the humid region, this potash is constantly being removed by the process of rain water leaching the soil. But this is not the case in the arid region, where the rainfall is deficient. The potash stays in the soil and enters into combinations, from which, however, it is readily liberated by plants. In the humid region it is effectually washed out, and so continuously that it is difficult to find in the drainage of the waters of the humid region—for instance, on the other side of the Mississippi—more than a mere trace of potash salts. It is quite otherwise in the waters of the arid regions. If you investigate the waters of any of our arid streams, they contain a very notable proportion of potash, as compared with other contents. River water is supposed to contain from 4 to 12 grains of saline matters. Well water contains as much as from 12 to 25, and even 30 grains. In the case of well water, the largest proportion is lime and magnesia. In river water, the predominating matter is usually salt of some kind, chiefly of soda—common salt—and salts of potash. The leaching process produces the same effect upon lime, but not so much so. That lime is soluble in water all are aware. Any one who has examined the bottom of a tea-kettle is familiar with the crust that forms and often causes it to be burned through; which is mainly compounds of lime and magnesia, which boiling brings down to the bottom of the tea-kettle. Lime, then, in the shape in which it appears in well water, is soluble in water. Therefore, when there is a large rainfall, and when that rainfall takes place during the high temperature of summer, the lime is leached out of the soil, and in the land of the humid regions it is leached out to a greater extent than is potash, for the reason that it does not enter into combination as readily as potash. In the humid region the measure of the first productiveness of all virgin soils is the lime, and may be measured in the light of the proportion of this ingredient.

Probably most of you who have had some experience in the East know something about the blue-grass region of Kentucky, and if so you have heard what is a common saying in all the Southern States, that a limestone country is a rich country. That is true almost without exception.



If you cross the Southern States in any direction, you will find rich streaks and poor streaks, and just as soon as you strike a rich streak, people say there is limestone underneath. In Mississippi, if you go from the east to the west in the northern part of the State, you will find alternately very rich and poor streaks, about twenty-five miles apart. Rich streaks are the boundary of the country called the lime country. Poor streaks are the pine country. We can tell from the presence of certain trees that there is lime in the soil. Now, this goes to show that all the soils in the arid region, except those in the high Sierra, are lime soils, and by parity of reasoning we might apply, and doubtless can apply, the adage of the humid regions to this country, and say that if limestone soils are rich soils, arid countries are rich countries. I think herein lies the explanation of the fact I mentioned at the outset: that the oldest civilizations have developed, historically, where aridity is the rule. In Egypt, Persia, and Northern India, everywhere, we find that an arid climate prevails, and that there civilization is the oldest, and everywhere there is a lime soil. That is at least *one* reason why the ancient civilizations have established themselves by preference in the arid regions, because irrigation of them, though costly in its first establishment, provides a much better sustenance to a much denser population than is possible in the humid regions. In the latter, fertilization is very soon necessary. In the pine region of the South the average duration of a virgin soil after the forest is cut down is from four to five years. Then it gives out and will not raise a profitable crop. When you go farther, to the prairies beyond, you find that the lands took thirty and even thirty-five years before they wore out so that fertilization became a necessity.

You have heard it said that in Egypt the overflows of the Nile keep the soil fertile. To some extent that is undoubtedly true, but you must remember that the overflowing of the Nile only lasts from two to three months, and the rest of the time the climate of Egypt is as arid as any one could desire. And what examinations there are of Egyptian soil, confirm what is given in this statement: that the soil contains a large amount of lime and potash, but a comparatively small amount of phosphoric acid—the three ingredients we are at present discussing. The same is true of India.

While in England, a short time ago, I spoke with an English chemist who had been sent by the British Agricultural Society to investigate the soils of India. Although his investigation had not been carried very far, a few analyses had been made, confirming the investigations I have made here with regard to the soil of California and the arid climate of the West. I say "I," because the arid regions have not before been investigated systematically and scientifically.

Although old civilizations did take possession of the arid regions, they were not the civilizations which pursued scientific investigation. These investigations have until lately not been made, except in California. Egypt has not been a source of scientific investigation, nor Persia, nor India, nor those other countries, for the simple reason that they are countries relatively inaccessible, and scientific investigation was difficult, on account of the constant upsettings in a political way. In fact, it is even now very difficult to get any data from them. There is one country in which alkali occurs, which has been within the limits of civilization for a thousand years; and yet it has not been investigated, and that

country is Hungary. I have lately called the attention of the Hungarian Government to this fact and to the analysis of the arid lands of Hungary. I found that it is a historic fact that the arid region of Hungary has been occupied by gypsies, and other people do not care to settle there. And now the Government is investigating the question of reclaiming the alkali land. They have alkali land, exactly as we have in this State, and this land is just as rich as can be, provided you can get rid of the surplus alkali. Alkali is peculiar to the arid regions, and the reason why the alkali is there is not that there is a special abundance of it in that soil, but it is simply that it exists originally in all soils, humid or arid, in the form of rocks, which ultimately go into the soils—they *remain* in the soil of the arid region, while they are washed out of the soil of the humid regions.

Let us see what is the composition of this alkali. If we look at the final result of the leaching of the land, we find it in the ocean. In the ocean we have the last outcome of the leaching of the land, because all the water that flows from the land finally reaches the ocean, and with it everything that is permanently washed out of the land. I have not a table of the composition of sea water, but out of  $3\frac{1}{2}$  per cent of solid matter about  $2\frac{1}{2}$  per cent is salt; the rest consists of gypsum, chlorid and sulphate of magnesia, and a certain amount of potash salts, but very small compared to the amount of soda. The reason of the large amount of soda compared with the amount of potash and lime in sea water is obvious: the soda is washed out of the land, while the lime and potash remain behind in a large proportion, notwithstanding that they are quite soluble. Here I have analyses of some California alkali, the alkali that most of you dread so much, and would like to do away with altogether.

Remember now, the three mineral substances that are of chief value in fertilizing are potash, lime, and phosphoric acid; nitrogen is another highly important element, and the most costly of all. Keeping this in mind, I call your attention to the table showing the composition of alkali salts from different portions of California; I have added some from Washington and Montana—it is the same there, the same in Egypt, in Hungary, in Algeria, as in the San Joaquin Valley. These analyses show the composition of 100 parts of alkali salts leached out of the soils; the latter contain, on the average, about a quarter of one per cent of them. Take the alkali salts from Tulare County; you have here in that from Visalia,  $6\frac{3}{4}$  per cent of pure potash, equal to over 20 of the best potash salts you can buy; there are also nearly 3 per cent of phosphoric acid. The alkali salts from our Tulare Experiment Station also contain wonderful proportions of these ingredients:  $1\frac{3}{4}$  per cent of potash, over one per cent of phosphoric acid, nearly 20 per cent of Chile salt-peter or nitrate of soda, which would cost you from  $3\frac{1}{2}$  to 4 cents a pound, and besides a per cent and a half of ammonia carbonate. Such material would be worth about \$8 per ton as a commercial fertilizer; for these ingredients are what we pay for in the latter. This table was not completed when I took it down to bring it here; I could extend it to the end of the room, showing you the same facts repeated elsewhere. You perceive that the alkali is very far from being an unmixed evil, if you can subdue the evil effects of sodium salts—the carbonate of sodium, common salt—and glauber's salt. The alkali soils then show extraordinary fertility and durability.



I will remark that in India, as in Egypt, there is a region which has been cultivated from time immemorial, where very little fertilization is required. It is on the highland in the middle district of Hindoostan. There is a heavy adobe. It is usually underlaid, at a depth of about six feet, by a loose sand. Into that sand, when the rain falls, enough alkali drains off to keep the adobe from being alkali. That has been cultivated as long as we have any history of India, without being fertilized at all.

I have in this table some results of analyses from Utah, Mexico, Colorado, and Wyoming. They are made by substantially the same method which I have adopted. They correspond almost exactly with the general results I have shown for Washington and California. There is no question about it. It is a universal fact, about which there can be no doubt. So far, then, you see that there are certain substances in the soils of the arid regions, not in California only, but all over the world where they exist, which are retained in them because they are not leached; and while phosphoric acid is not in this category, because it forms an insoluble compound, it is certainly true for potash and lime.

In regard to the bottom soils—say the bottom soils of Riverside—let us see how this is. If you go to the creek bottom just beyond Rubidoux Mountain, at Riverside, you see an abundance of alkali in that little bottom. Riverside is free from alkali on its upland, because enough rain falls to wash out a good deal of it, and irrigation is practiced to such an extent that the alkali is washed into the valley. Nevertheless, not all the alkali is washed out of the soils of Riverside. That is why I have said you had better spend money on phosphoric acid and nitrogen, and not on potash, until you find that such fertilizers fail. While potash is being washed out of the soil by every rain, and it hardly seems reasonable that you should have to supply it.

The general truth holds good that potash and lime are very abundant in the soils of California; unfortunately, as you see by the general average of California in the table, phosphoric acid is relatively deficient. In Montana, the average is nearly double that of California. Therefore, my advice has been to spend money for phosphoric acid, then for nitrogen, and then afterwards, if there is any lack, for potash.

I have given this statement in order to show that you must be cautious in applying the experience of the East to this country. The trifling amount of potash that exists in Florida soil may well need replenishing. The immense amount of potash in California soil shows that the presumption is that in ordinary cases no such fertilization is called for.

As there is a decided difference in the *soils* of the humid and arid regions, we should expect naturally that there would be some difference also in the *fruit* grown; and I may say that the difference I have found in the analyses made by us of California fruits, and comparing them with the analyses made from the old country and from the East, fully bears out that expectation, and here again I may say that the work we have done on these fruits at the Experiment Station at Berkeley exceeds in amount the whole that has been done in Europe in that line, just as the soil analyses exceed the amount of all the similar work that has been done heretofore.

I remarked at first, in regard to this table, that the analyses having a red star represent results we have reached by our own investigations. The others are results we have taken partly from the East and Euro-



pean determinations, and we do not vouch for them, but I will give off hand, from my manuscript, some data in this regard.

First, let me state how many analyses the starred results represent: Of citrus fruits: oranges, 130; lemons, 45; total, 175 analyses of citrus fruit. Of stone fruits: prunes, 36; apricots, 14; plums, 3; nectarines, 1; total, 54. Olives, 26. I have not given the olive analyses here because they are not in the same form as this table. We have made analyses of 2,136 grapes and grape musts, and of 1,500 wines. I claim that such a series of analyses deserves very much more credit than half a dozen or a dozen, if made elsewhere, of the same fruit; and I claim from these analyses more authority than any European analyses can possibly give. It seems to me that in the compounding of fertilizers and in connection with orchard fertilization, our analyses should represent our fruit and not the analyses of Europe, no matter by what name they are backed.

I will give you a few data in regard to differences we have found. The important point covered, without reference to fertilizer, is the amount of sugar contained, the amount of acid, and then the amount of ingredients that represent their truly nourishing factors. You know that our own flesh is derived purely from the same ingredients contained in plant or animal food—if in animal food, meats, etc., it comes originally from plants or vegetable food consumed. There are certain of our foods that are supposed to be specially nourishing; for instance wheat, among the cereals, the highest of all; among the vegetables, beans and peas are esteemed most highly, because they contain the largest amount of those flesh-forming ingredients, or albuminoids, as we term them chemically. I will give some comparative figures in regard to the contents of the three chief groups—sugar, acids, albuminoids—in the California fruits.

We have in the apricot, 12 per cent of sugar, against an average of, at the most, 10 per cent in the European fruit. The usual content of the European fruit is 6 per cent, but for southern Europe alone we can make it up to 10. We therefore have more sugar in the apricot by far. The apricot of France, in particular, contains only 6 per cent of sugar, while ours has an average of about 12 per cent. In the California prunes we have 16 per cent of sugar against 6 per cent in the European prunes. That is a surprising result, which, however, I have verified; the large series of analyses we have made show definitely that our prunes contain so very much larger a proportion, nearly  $2\frac{1}{2}$  to 1 as compared with the average of all the prune analyses we have been able to get together. Probably if we had the Italian prunes to make a perfectly positive comparison, the figures would have to be somewhat varied. These refer only to French prunes. We have brought together, as nearly as we can, all the analyses of the other countries.

MR. SPRAGUE: That is, the prunes in each case are similar in variety.

PROFESSOR HILGARD: Yes. In ordinary plums we have in California  $13\frac{1}{2}$  per cent of sugar, against about 5 in Europe. As to plums and prunes, we have found prunes at Mr. Gillet's that contained over 20 per cent of sugar, which are more nearly like dates than any I have tasted. In grapes we have an average of 26 against  $21\frac{1}{2}$ . In peaches 13 against  $4\frac{1}{2}$ . In oranges,  $7\frac{1}{10}$  against  $4\frac{6}{10}$ . Figs, 19 against  $11\frac{1}{2}$ .

Now, this is not surprising, because the European countries in which these fruits are produced are not arid but humid regions. Italy is not an arid country, and therefore the production of sugar is not so high. The south of France comes nearer to us in the production of sugar in

fruits. In almost all of these cases, when we compare, there is a corresponding excess of acid in the European fruits. In the European grape the average is about .8 per cent; our average is about .5 per cent.

The differences in the flesh-forming ingredients are still greater, and it is very remarkable that in nearly every case the California product is far ahead of anything that European fruits can show. Take the albuminoids in the apricot—we have a proportion of 5 per cent in the Californian against 2 in the European. It contains two and a half times more of flesh-forming, nourishing ingredients than the European. In the prunes, 5 to 4; in plums, 11 to 4; in figs, the difference is also somewhat in favor of the California product, but in the case of oranges, the difference is the other way; why, I do not know. But we have, in the case of oranges, as I have told you, a very large number of analyses; we have eighty, I think, all told; there can therefore be no question about the fact. It is a very much larger average than we can get from Europe.

I could go through this table showing the composition of the ashes of fruits, and show there are very wide differences in these also. Among them is, that the amount of potash in the California fruit is less than in the European and Eastern fruits by about 15 to 18 per cent. The California fruit contains that much less potash than does the European; although our soils are so rich in potash, our fruits draw less upon it on the average.

In phosphoric acid, the difference is very great; in some cases the difference is so great that I cannot help suspecting that there was some error in the European analyses. The amount of phosphoric acid required by the fig is large at best; in the analyses on record we find that California figs contain nine times more phosphoric acid than the European fig, but I must confess that the European fig analyses on record are not many, and as they are probably not very reliable, I doubt if such a difference exists. However, in the case of the orange, we find that the California orange contains 13 of phosphoric acid against 11 in the European. In the prunes, the difference is very great, .68 against .95.

You see, then, that alongside of the very small percentage of the phosphoric acid in our soils, some fruits draw more heavily upon them, for some reason, than in Europe. Our average is from such a large number of analyses that I cannot doubt the correctness of these facts.

In the matter of nitrogen, the third substance, which is by far the most expensive of replacement, the difference is frequently great. The California fruits all draw much more heavily. In the case of apricots, 60 to 25. Our apricots are more than twice as nourishing, so far as the European analyses show. In prunes, 50 per cent of nitrogen against 30 of the European. In oranges alone the difference is the other way; we have 37 in California against 54 in Europe.

I might continue and show more of these differences, but my object is not now to go into detail in the matter, but in the main to show you that these things require investigation, and that you must not take it for granted, because some distinguished man in Europe or in the East has made analyses and given a certain result, that you here in California can rely on that. You cannot do so. As I said before, the arid region has now for the first time come under examination as to the chemical composition of soils and products.

## ROOT KNOT.

A lengthy discussion followed on root knot, and the means adopted for its arrest. The conclusions reached were that as yet the cause producing the knot is unknown. Professor Hilgard asked that the growers furnish him with specimens of root knots during the different months of the year for investigation.

Mr. Lelong reported having made extensive experiments to establish the fact of its being contagious or not. More than one thousand trees were inoculated with the knot at different periods of growth in all months of the year, and none took or distributed the disease to the trees. Many were budded and grafted with knots, but none took, proving that the disease is not contagious, at least in the stages when grafted and budded. He said it was possible there was a time during the period of growth when the disease would spread and be contagious, but that the particular time was not known. These were the first experiments conducted in this line, and others will follow.

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## ORCHARD FERTILIZATION.

By A. SCOTT CHAPMAN, of San Gabriel.

I will give you my experience on my ranch. It is situated about twelve miles east of here, on new granolithic sand. There is no bottom water. The analysis is about 1.14 per cent of potash, 2 per cent of lime, 0.16 per cent of phosphoric acid, and 0.01 per cent of sulphate of soda, a maximum crop of oranges being about one hundred boxes per acre; which would remove from the soil about 28 pounds of phosphoric acid, 10 pounds of sulphuric acid, and 63 pounds of nitrogen. When I took hold of this business I had plenty of water and I irrigated freely. The chaparral had never been cleared off. I cleared it off and found weeds, such as mullein—clover did not grow; alfalfa did not grow, except one species. I commenced fertilizing with sheep manure at the head of the irrigating ditches, and distributed it all over the orchard freely. The sheep manure was full of clover and alfalfa seed. These seeds did not grow. The following year I fertilized with phosphate made from bone black in San Francisco, treated with sulphuric acid, and an immediate change took place in the color of the clover which came up. I afterwards fertilized with bone-meal, supplying phosphoric acid and nitrogen. I found that to be a complete fertilizer for my soil, running as high as it does in potash, phosphoric acid, and nitrogen. My orchard was suffering from yellow scale. It has since died out by reason of the parasite. The white scale has affected the trees very much. The last crop I had was three hundred boxes, but when I saw the work of the *Vedalia cardinalis*, I put all my money into a carload of sulphate of ammonia in Cleveland, Ohio. I put this on my land, and during the summer my orchard turned green and took on a luxuriant color. The trees blossomed in the winter and were set with fruit, and I had over three hundred boxes the following year. Still my place did not have the appearance I wished it to assume. One day Dr. Woodbury came out to see me, and wanted to get some of my lemons to make oil of—the



oil of lemon—and citric acid also. I told him what I had done—the effect of the phosphoric acid—and he asked to make an experimental test on the part of the ranch that had not been fertilized. I made several experiments. We applied nitrate of soda, pure and simple. I obtained phosphoric acid, made from burned bones in San Francisco, treated with sulphuric acid, getting pure potash. Also, pearl ash dissolved in water; nitrate of soda and potash. One solution was phosphoric acid and nitrogen, and another was phosphoric acid and nitrogen and potash.

Now, if potash was not lacking in that soil, analyzing as high as it did, it would receive nitrogen and phosphoric acid. One soil receives the complete fertilizer, by which you will understand nitrogen, potash, and phosphoric acid. It looked beautiful. It was much superior to any other place in my county. I concluded that a little potash was absolutely necessary. I ordered from San Francisco a fertilizer which was 10 per cent potash, 10 per cent phosphoric acid, 3 per cent nitrogen. I applied that. My trees now have a healthy appearance and the place is looking extremely well. As I said this morning, I was able to pay the railroad over \$250 an acre in freight. I continue to grow clover and such weeds in order to have a supply of humus in my soil. I wish to maintain my orchard as though it was a nitrate bed. Nitric acid grows one part in 10,000. The leaf takes up all the carbon which enters into the combination of the plant, and 95 per cent of the plant, exclusive of its water, is carbon derived from the atmosphere.

Now, I have a small vineyard, composed of Flamy Tokay grapes and other grapes. The other grapes bear a little fruit—not very much—but we have been able to rely upon the Flamy Tokays for several years. This year I have a double crop. I applied last winter a fertilizer from a compost of cow manure, treated with muriatic potash, 200 pounds to the acre, also 75 pounds of sulphate of iron to the acre—an exceedingly large dose. Previous to this summer that orchard was full of black knot. I could break off pieces as big as my fist. This last summer I had no difficulty in disposing of the grapes. Every one told me they were the most beautiful Tokay grapes they ever saw. So much for a good fertilizer.

I have one more experiment to report. I had a small area of lemons. I put sulphur on the trees early in the morning when the trees were wet with fog. The sulphur adhered to the trees and there is not now any scale in the neighborhood. These trees have an exceedingly luxurious appearance, and I believe that sulphur will be a great thing for my orange orchard. I got the idea from a gentleman who experimented with sulphur to prevent the red spider. I have recently put the sulphur in a seed sower and driven through the row, with a perfect cloud of sulphur coming out from behind the wagon, and as I was ahead I was out of this cloud of sulphur. For several rows on each side, the sulphur extended, settling all over the trees. I quote that experiment thinking it may be of interest.

MR. BERRY: Mr. Chairman, I wish to say a few words in regard to the fertilization of fruit. The proposition suggested by Mr. Chapman, who has just spoken, is perhaps of great interest to citrus fruit growers, as well as to growers of deciduous fruits.

THE CHAIRMAN: There are two more papers to be given on the same subject; discussion will then follow.

## FERTILIZATION IN RELATION TO IRRIGATION.

By PROF. S. M. WOODBRIDGE, of Los Angeles.

Plant growth may be likened to a circle. It takes three hundred and sixty degrees to make one. If one degree is missing you have no circle. And so it is with plants and their products. Of all the elements that go to make up plant life each is essential, and if only one of the least of these is missing, nothing will grow; as are, also, the conditions essential which must exist in order that chemical action—atomic motion—may be carried on. It becomes us, then, to consider these elements and the condition of their action. Let us contemplate for a few moments this wilderness of matter—this labyrinth of nature—and reduce it to units, for use on the ranch.

You may ransack the earth, you may search wheresoever you will, from the tops of the Himalayas and Andes to the very bottom and ooze of the sea; from the rugged coasts of Labrador to the diamond fields of South Africa; from Greenland's icy mountains to India's coral strand, and assuming that you have obtained samples of everything within the range, either in heaven above or on the earth beneath, or in the waters under the earth, and that all these innumerable number of samples had been reduced to their constituent elements, you would find that you had but sixty-five. Of these sixty-five elements, but thirty-five are what may be called common; the others are called rare, and seldom play any part in the affairs of man.

You may retrace your steps and make the circuit of the globe, looking only for organized forms of matter. You may examine these minutely in detail, from woman, that noblest work of God, to the merest protoplasm or microbe. You may examine all the foods of man and beast. You may enter the vegetable kingdom and examine it, from the coarse growth of the rank marshes reeking under a tropical sun, to the vegetation that lies buried for more than half its time 'neath snow and ice in the uncongenial clime of the far north. You may examine all the colors of the flora, from the deepest scarlet of the Jacqueminot to the more delicate shades of the exotics. You may examine all the odors that are the products of growth, from the sweet violet and the night-blooming cereus, to the rank garlic, the insidious tobacco, and the skunk cabbage. You may examine all the flavors from the dulcet of the orange, and the honey that lurks in the bud, to the heat of the cayenne pepper and the bitter of galls. And assuming that nothing within the range has escaped your notice, and that samples of all the products of growth had been gathered, and that all this innumerable number had been reduced to their constituent elements, you would find that you had but fifteen elements. One of these fifteen elements—namely, iodine—is distinctly a product of sea plant, therefore you, as land animals dealing only with land plants, have but fourteen elements to consider.

For the convenience of becoming acquainted with these fourteen elements, let us classify them. How much easier it is to remember and reproduce classified knowledge than it is a lot of isolated facts! Science is nothing but classified knowledge. The fourteen elements may be divided into three classes:

1. The air elements, or those that are derived by the plant solely from the air. They are carbon, hydrogen, and oxygen. These are always present and in sufficient quantities to maintain their part of plant life.

2. The soil elements, or those that are derived by the plant from the soil. They are potassium, sodium, calcium, magnesium, manganese, iron, sulphur, phosphorus, chlorine, and silicon.

3. The third class is composed of but one element, viz.: nitrogen, and I make a separate class of it, because it is derived by the plant from both the air and the soil.

It is, then, a combination of some or all of these fourteen elements that makes organic life, and this is built up by chemical action. Chemical action is atomic instinct, and atomic instinct implies atomic motion, and atomic motion is going on everywhere unceasingly, under the immutable laws of God.

There is in life everywhere a certain unrest, and this from the very mind of man to the simplest of the elements in the soil beneath your feet—a continual chemical action—atomic motion—a union and disunion, a marriage and divorce of the elements, in utter disregard of all moral laws.

Who has not marveled as he first beheld one of those majestic redwoods, towering three or four hundred feet above his fellows, and spanning, perhaps, many centuries of time? What is it, and whence came it? And, for that matter, what is all life, and whence came it? Beginning with a mere vitality, gathering to itself certain inorganic elements, putting them together in an organized form, flourishing for awhile, and then, what we choose to call life ceases to exist. Death! No. At that very moment another life begins. 'Tis the life of decomposition, disunion, divorce. It is chemical action—atomic motion—no less in power and strength than that which built up the first life. The air elements returning to the soil, whence they came, and the soil elements to mother earth, whence they came, who stands ever ready to receive her children within her bosom when they have run their little course, there to let them rest and recuperate before entering new forms and running a new course of vitality. Yes; the earth is the material mother of us all, and when their course is run all her children go home to her—dust to dust.

"Imperial Cæsar, dead and turned to clay,  
Might stop a hole to keep the wind away.

Well, these eleven elements which the plant takes up from the soil are essentially plant foods, and of these there are, as a rule, only three that any soil is likely to become deficient in. They are nitrogen, phosphoric acid, and potash, and sooner or later they have to be returned to the soil. There are some other substances, such as the sulphates of iron and calcium, that may be profitably added under certain circumstances and on some soils, but I must not digress. This being so, there are but three expensive elements that can enter into a commercial fertilizer.

To recapitulate: There are but fourteen elements that enter into plant growth. Three of these are derived from the air and eleven from the soil, and of these eleven there are but three that soils are apt to become deficient in. That statement is simple enough. Let us avoid even the terms "complex" and "complicated" in connection therewith. Nature is always simple, direct, and positive in her ways, although man, in the confusion of his mind and in his desire to appear learned, is apt to be profuse in describing her methods. We want scientists as leaders who



will unravel what appears to be mysterious and complicated and give the results of their researches in plain, attractive, and concise language.

Having shown what are the elements that go to build up plant life, we will now take up the conditions under which they *are* built up—not including climate, however.

The great German chemist, Liebig, formulated the proposition that plant foods, in order to be available, must be soluble. This implies a menstruum, in which they are to be dissolved. Of course there is but one—*water*.

The relation, then, of irrigation, or water, to plant foods is important; for if on the one hand we do not get water enough, certainly there will be nothing to dissolve the plant foods, and under such circumstances chemical action—plant growth—cannot go on, as all Western men practically know by looking at arid lands in the dry season, and as all Eastern men know by looking at their good wife's house plants. On the contrary, if too much water is applied, so that it either soaks down below where the roots reach or drains off the land, the soluble plant food that is dissolved by such excess of water is either carried down below the roots or runs off the land, thus impoverishing the soil. Where too much water is applied it is a leaching process that is going on, not a filtering one.

I wish that this distinction would be borne in mind by all irrigators, and especially by those who own their own water. I have asked many of the latter class how much water they were applying, and with but one exception they have all answered that they did not know, generally adding "that it costs nothing." These gentlemen, as a rule, irrigate by the so-called "modern method," which consists in running the water down through furrows, claiming that it is the easiest and cheapest method. In more than one instance it has been said that so long as the water was put upon the ground, it made no difference how it got there. One might as well say that it made no difference in the meaning of a sentence how it is punctuated or expressed.

It behooves us, then, to look carefully at the proper application of water to the land. While we must be sure to get enough in order to maintain chemical action, we must be careful not to get too much, so as to leach out the soils and uselessly impoverish them.

It seems, then, that inasmuch as the roots of the trees in an orchard form a perfect network through the whole soil, it is necessary to get an even distribution of the required amount of water over the whole surface of the land. This, certainly, can be done by the basin method.

The so-called "modern method" should never be resorted to, except where it is absolutely necessary, and then the head ditches should be very near together, and the furrows small and numerous. I know that this method is very popular, easy, and cheap, and, what is more and worse, many people are in the habit of so irrigating. We are all creatures of habit, and what we are in the habit of doing is very hard to change.

The person who is in the habit of irrigating by the furrow method finds it very easy to turn the water on in the morning; get it regulated with close watching all day. At night he takes the last look, and finds it working well, goes home, and permits the laws of gravity to carry out the process while he sleeps, and awakes in the morning to find that these laws have not been suspended, and the water still running down hill. The specific objections to the system are:

*First*—As a general rule, anywhere from double to five times the amount of water is used at an irrigation that is used in the first and second methods above mentioned; and,

*Second*—That the water applied by the system is very unevenly distributed.

To illustrate: On a piece of heavy red soil, one hundred and eight feet long, the water was turned in the furrows and left to run for three hours. On the following day, digging revealed the fact that at the head ditch the water had penetrated fifty inches, and that at the distance of one hundred and eight feet it had not penetrated twelve inches.

How deep the water would have percolated at the flume, had it been left to run three days, and what amount of leaching might have been done, we can only conjecture by looking at the yellow and unhealthy condition of some of our older citrus orchards, and especially at the upper end of such orchards, that have been irrigated by this so-called modern method. There are two modifications of the system which are improvements. The first consists in piping the orchard, say every tenth row, so that the furrows are short. The second consists in running cross-furrows parallel with the flume, thus making temporary basins. Here, certainly, is food for reflection, and a subject to be investigated with profit.

The Directors of Agricultural Experiment Stations might give their attention to the subject, and determine the amount of water necessary for differing crops, on widely varying soils and in diversifying climates.

When we see a large excavation, great heaps of building materials, and enormous timbers, are we not justified in drawing the conclusion that a large edifice is to be erected? So, when we consider the vast extent of territory comprised within these United States, with its numerous rivers and harbors; its enormous resources of field, mine, and manufacture, brought together by a vast system of railroads; its borders filled by a thinking and progressive people, whose children are taught to read and write—are we not justified in drawing the conclusion that a great nation is to exist here? Aye! the greatest nation on the face of the earth! And where in all this fair land is there a more favored spot than this of California? It is better than if it were flowing with milk and honey.

You have a climate that is simply perfection. You are surrounded by scenes that are enchanting beyond description, and you have soils that are naturally rich, but you must maintain their integrity. You would not think to milk your cow for long without feeding her; wherefore would you think to crop your fields without feeding them? You cannot do it. With the integrity of your fields maintained and an economical utilization of the waste products of the ranch, and a continuance of the progress already manifest among you, future generations will think the poet a fanatic who could imagine, much less desire, a time "When earth should have commerce with the stars."

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#### DISCUSSION ON GUM DISEASE.

CAPTAIN THOM: Have you ever thought that by the ancient system of irrigation, such as you have just described, the trees are very much more liable to the disease known as the gum disease?

PROFESSOR WOODERIDGE: I have investigated that, so far as I have been able, and I find there is more gum disease where the furrow method is resorted to than there is where the basin method is adopted.

MR. SPRAGUE: What do you mean by gum disease?

PROFESSOR WOODERIDGE: It seems to be a cracking in the bark and an exudation of the gum, which sooner or later runs down the tree and affects the bark underneath.

JUDGE HEATH: I believe a tree affected with gum disease should be burned up at once. I can go into portions of my orchard that I have watched closely for thirty years, and point out the spots where the different systems of irrigation have been tried. I do not think this disease can be indigenous to the soil.

MR. LELONG: I will give a little information about my experience with the disease. I have had about twenty-five years' experience. The trees I first treated were about forty years old. We tried to save those big trees, if it could possibly be done. We had to tie the trees, so that they would not fall over, and we found at that time that where the gum disease half-circled the tree the bark underneath was injured to such an extent that it had decayed and rotted. Then again, we found a great many instances where there was one little spot on the tree where the gum was oozing out. By cutting that away you would find a dark canal, and this gum disease would go there, and sometimes we would trace it to the top of a tree thirty feet high. The sap of a tree does not go, as many suppose, all around and up, but it goes up on the side and through these cavities on the tree, and it seems to me that wherever the disease entered into the sap of that tree, it would take it up through the entire tree. We tried this experiment, which was very costly, and after about five years' experimenting with these old trees, it was finally concluded the best remedy was to take them up and burn them. No tree was cared for, excepting when the disease had just started, and then, if it was cut out and left alone for a few days, and then gouged out some more, until we had the whole of the disease taken out of it, it would break out of the other side. It was my experience that it went to the root as well as to the top of the tree.

JUDGE HEATH: You stated the roots of the trees, the tree being girdled, sometimes there would be only one root left. That was an orange root, was it?

MR. LELONG: Yes, sir.

JUDGE HEATH: Is it not a fact that you can take an orange tree and girdle it entirely, and save the tree?

MR. LELONG: I have had no experience in that way, and I have been very much surprised at a tree, which was entirely girdled, in which I noticed last spring new bark and leaves coming out, and I think the tree is going to be saved.

JUDGE HEATH: I have seen trees completely girdled by gophers. I had an orange orchard adjoining my lemon orchard, and the gophers on my place were very bad until I have been able to kill them off entirely. The gophers did not trouble my lemon orchard. I have never lost a lemon tree, and the trees are twenty-seven years old. But the gophers were so bad that they girdled my orange trees, sometimes as much as six inches wide, and yet my trees lived and are living and bearing fruit to-day.

MR. LELONG: When the gophers took this bark off, did they eat into the wood and disturb the inner layer, which becomes new bark?



JUDGE HEATH: Just simply left the wood of the tree. I refer to that simply to get at this gum disease in the lemon. If you girdle the lemon tree, there is nothing in the world that will save it. The orange tree appears to be the exception in our fruit trees. Of course, the gopher in eating simply eats the bark and does not disturb very much of the wood. Now, I happen to have one lemon tree in my old orchard which has the gum disease. I know how that gum disease occurred. It occurred by a careless fellow plowing and abrasing it with the plow. Those trees are on a lemon root. That is the only tree I have that is diseased in that way.

MR. SPRAGUE: How did you kill your gophers?

JUDGE HEATH: I bought strychnine and used it on vegetation. I hired men to go around and put the strychnine in small pieces in every hole. That did not eradicate the gophers on my place. There were a great many of them, and they were constantly doing me a great deal of damage. I had a great many cats, but the cats could not get away with the gophers. I bought a lot of traps, and hired men and gave them 5 cents apiece for every gopher, and to-day my place is as clear of gophers as any place in California.

Now, with regard to this gum disease; I have been experimenting considerably on that tree. The tree bears a great deal of fruit. Of course, when you check the growth of the tree in that way, either by root pruning, or otherwise, you force the strength of that tree into the fruit. All you gentlemen having orchards have observed that if you have a tree that is bearing no fruit, and has borne no fruit for several years, you can force that fruit by cutting some of the lemon roots. Now, if you affected the tree otherwise, you might force that tree into bearing fruit. This gum disease has forced the fruit of this tree. It is a large tree and bears a large amount of fruit. I commenced experimenting on that tree, cutting the bark carefully, and found the wood under the affected part to be dead. By dead, I do not mean to say that it is rotten. It is as hard as bone, and no sap could flow through the pores of the wood or be affected by it, and could not go up or down in the grains of that wood. It is hard, dry stuff. But if the disease were to follow down, it would run into the ground. Now, I agree with Mr. Lelong exactly. It is my opinion that the disease in that tree of mine, instead of going down, does absolutely go up on the bark. The tree is almost dead, although half of the bark on that tree is alive; yet, by taking the point of my knife and running in on the side of the bark, where it is apparently green and lively, where the sap would flow and new wood form, there is a yellow substance which appears to be fresh bark. I am satisfied the tree never could thrive, and I am satisfied, with all I have tried, and I have tried everything, that the rot will kill that tree, and nothing under heaven can save it.

PROFESSOR WOODBRIDGE: May I ask a question about these orange trees that have been girdled? Have they not their own roots above the girdled part, so as to keep them alive and get into the soil?

JUDGE HEATH: Years ago, when some of the older people here can remember the old round-house in Los Angeles, they will remember a gentleman who had some orange trees, and the tops were cut off and the trees transplanted, and some of them were injured. I happened to be here, and observing those things, knowing the gentleman, and seeing that some of those trees were injured pretty badly by having the bark

off—my oranges had been planted and had been girdled by gophers. Now, the gopher had come out of the ground and girdled the tree from an inch above the ground to six or seven inches high, and before I had observed it a number of the trees were completely girdled above the ground. When I did see this, I cut the tops off, just the same as I would if going to transplant a large tree. I put nothing on the trees, but I left them there. The soil was sufficiently moist, or if it needed water I irrigated them, and gave them plenty of water. Gradually the tree healed, but not from the bottom. The bark grew from the upper part where the tree was girdled, and continued to grow down until it united with the bark next to the ground. That thing occurred in more than twenty instances, and the trees are alive and bearing to-day.

PROFESSOR WOODBRIDGE: I ask Captain Thom. How long since you first applied carbolic acid to your trees?

CAPTAIN THOM: I have applied it for the last three or four years. I have found out, in the orchard of which you have spoken just now, that when I cut it out on the one side, it breaks out on the other, and in my opinion the orchard containing ten or fifteen trees had better be taken out. I do not believe there is any remedy. I have been attending to these trees assiduously for three or four years, and I have applied all sorts of things to them. I have attempted to remove every vestige of the disease. This disease in many cases extends to the roots. The roots are absolutely rotten, not hard, but decayed, and in experimenting above with the knife I found that the tree indicated the possibility of a recovery. The next season, the disease makes its appearance somewhere else, either on one side or the other. They bear. They are the most inveterate bearers I ever saw. They are full of fruit to-day. I think it is a matter worthy of the strictest attention of the horticultural people of this part of the State.

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#### CLAIM OF YOUNG & POWERS.

MR. ADAMS: Mr. President, I take this opportunity to introduce a resolution, which I have been requested to prepare, as expressing the sense of the convention, so far as we can judge, in regard to the money matter which came up this morning. We desire that immediate action be taken upon it.

*Resolved*, That this convention, representing more directly than any other body the horticultural interest of California, acknowledges the indebtedness of that interest for money honestly and necessarily expended in its behalf, in promoting legislation for the protection of our orchards from predaceous insects; that the money is due for professional services and for expenses in drafting the bill and repeatedly arguing the same before legislative committees in our behalf; that the value of the services is proven from the fact that the law enacted in our interest was promptly decided in the Courts and sustained by them, thus providing us for the first time with a local means of protecting the industry from the consequences of neglect and indifference on the part of absent owners of fruit orchards; that certain persons, acting in our interest and at our request, have been personally sued; that the sum due, and for which our representatives have been sued, is \$600, which is a compromise amount for which these claims can be settled; that Mr. Lelong be, and he is hereby appointed, a committee of one to collect from the fruit growers the sum above stated to be due.

Adopted.

A recess was then taken till 7:30 P. M.

21H

## XXVI.

## EVENING SESSION.

Vice-President KINNEY in the chair.

## IRRIGATION.

By JAMES BOYD, of Riverside.

That the subject of irrigation is of world-wide importance we have only to look back a month or so ago to the International Irrigation Congress and look at the list of delegates from all parts of the world. The Orient and the Occident, the Northern and Southern Hemispheres, all the leading divisions of the globe were represented, and all manifested a lively interest in the proceedings. Although this unusual interest is of modern date, we cannot by any means suppose that irrigation is a new idea. Almost all of the civilized races of the past of which we have any record practiced irrigation, and there are some races of which we have no record, notably on our own continent, that have left no traces of their history outside of the remains of their irrigating canals. Under the ancient civilizations the necessity of irrigation will be apparent when we consider that under their comparatively rude form of agriculture, with their meager mechanical appliances for tilling the soil and for gathering their crops, and when we consider further the barbarous nature of most of the people surrounding these civilizations, and the dangers they were in from the outlying savage races, it is not to be wondered at that as people became civilized they clustered together for mutual protection as well as for the enjoyments of society. Hence, the necessities of the situation demanded that the soil should be drawn on to its utmost capacity; and under the semi-tropic climate, where most of these civilizations existed, by a proper system of irrigation the soil could be made to yield its rewards all the year round. With the limited means of transportation, one country could hardly be drawn upon to supply a scarcity in another, hence irrigation, with its certain increased production under intelligent management, could be depended upon to avert most natural shortcomings or calamities from failure of crops.

Whether the ancients were troubled with the problems of transportation or middlemen or false plans of distribution cunningly devised to rob the producer, we are as yet in ignorance, but as much of the manual labor was in all probability slave labor, their troubles undoubtedly assumed a different form from what they do in our day and generation. Whether fruit raising in ancient times bore any such relative importance to grain raising as it has assumed in modern times history at best is very doubtful, and we can only judge from the few fragments that have been handed down to us that it did not, hence we are reasonably safe in saying that it did not, and if the surmise is correct we can again safely say that as a race we have taken some steps in advance of the historic or prehistoric past. As a rule, our arid regions are situated in the southern part of the temperate zone, where the climate is mild and healthy. The founders of this republic settled in the naturally rich and well-watered plans farther north, where the climate is oftentimes severe and unhealthy and where also a growing civilization renders the denizens



more susceptible to unfavorable conditions, compelling much indoor life for a large portion of the year, in this way favoring a tendency to poor health and abridging much of the pleasures of life and even life itself. Man also is formed for society, and the progress of the race can best go on by constant social intercourse. A time, however often, comes to man wherein he loses much of the pleasure of social intercourse by reason of ill health, and then the world is ransacked in search of a place in which to regain health and enjoy life. To the man of wealth this is comparatively an easy matter, but to the poor or those of limited means until of late years almost an impossibility. It has been known as long as our country has been known that our arid lands presented the best climate that any person in search of health could desire, but the problem was how best to utilize it for those who had to make their living as they went along. That problem has been solved by the one word, irrigation.

Colorado and California present two of the best and most successful examples of irrigation development on economic and hygienic lines so far, and had it not been for good hygienic reasons our irrigation development under our modern system of irrigation might still have been in an embryotic condition. And while the writer speaks of irrigation in this connection—he has not the smallest intention of detracting from other parts of our country, which are equally as health-promoting as this, or saying that other places, which do not make a specialty of healthfulness, cannot make a success of irrigation—the broad assertion cannot be denied that a health-giving climate, in which outdoor vocations could be carried on every day in the year, has been the greatest factor in hastening the spread of irrigating waters over our fertile State. Take Riverside as a type, because she was the first in point of time, and her first settlers were more or less invalids and health-seekers fleeing from the rigors of Eastern winters. Is it any wonder, then, that on regaining their health and finding a genial climate they gave themselves, heart and soul, to the development of this part of our country. And as that could not be done without water, water development has been almost a mania with them, and Riversiders have taken a large hand in developments elsewhere.

It has always been a custom with every nation that they should take with them, whenever they migrated, their household gods, their *Lares*, *Manes*, and *Penates*—and our modern wanderer takes his too, but in the form of all the accessories of our latter-day civilization. In our day we are not content unless we can make our cities, like Jonah's gourd, almost spring up in a night. Our churches and our schools, our newspapers and our public libraries, our high schools and our colleges, with all the concomitants of railroads and telephones, driveways and boulevards bordered with fountains and shade trees, green lawns and fragrant flowers, and all that goes to make life a pleasure and to remind us what paradise ought to be, spring up under the heels of our pioneers. But these things are hardly possible, except under a densely populated country, and these we can secure under a judicious system of irrigation. While our sons and daughters have been leaving the farms, with the loneliness and isolation of the past, and flocking to our cities, with their supposed social and other advantages, some of our citizens have been trying to combine all the best features of both, and this, it is found, can be best accomplished where the climate is mild and dry and water is

plentiful for irrigation, and now the current is going to be reversed, for it is being found that our cities, under modern conditions, are not so favorable to the growth of what is best in intelligence and morality as is the modern colony in the country, where the productions of the soil, such as fruit, demand manual labor combined with intelligence.

In a meeting of horticulturists the subject of irrigation could hardly be treated of without some allusions to fruit growers in connection therewith, and although it is not the purpose of the writer to decry the culture of fruit without irrigation, or to in anyway undervalue any of the results, it may be permissible to say that but for irrigation much of our best fruit lands necessarily would be still a desert waste, and some of the special productions of the irrigated regions would be almost unknown in the great markets of the East.

Whether the home-seeker shall buy land where the rainfall is sufficiently abundant to raise crops every year without irrigation, or whether he shall take the drier lands and climate where water is abundant, each must choose for himself. There is a faculty in the human mind that is inclined to make the best of everything, and so whether a man buys land with water or without he will be generally inclined to assert that his individual choice has been the best.

Northern California and Southern California may be taken to be representative of the two systems, and we of the south keep pace with you of the north. Our main crop comes in at a time when you have but little to ship, and so when you get through with your shipping season you send down your idle fruit cars and we fill them with our golden fruits, and it so happens that in this way there is a constant stream of fruit crossing the continent to supply the necessities of those who are engaged in other branches of industry, and it looks now as if the development of our products by means of irrigation had just begun, for, not to speak of the undeveloped resources of our irrigable lands in our fruit-raising districts in Southern California, Southeastern California and Arizona have as yet but begun to ask the people of other States to come in and help them occupy the lands that were occupied thousands of years ago by prehistoric irrigating races.

What our railroads have made possible in the settlement of our vast inland domain, by bringing it within the reach of settlers, will have to be largely supplemented by irrigation. Much of the products of our irrigated lands must necessarily be grown for outside markets, for under our modern system of internal commerce, made possible and necessary by railway communication, each section of our common country is largely devoting itself to its own specialties and depending on other sections for what can be produced elsewhere more economically.

Our irrigated regions will always be celebrated for the production of the finer qualities of fruit, both fresh and dried. The drier the climate and the more bountiful the sunshine, the better the quality of the fruit and the better are the crude juices transformed into the health-giving elements that are often found necessary in moister climates, so that it may be said that in shipping fruit from our sunny climate we are shipping concentrated sunshine to cheer those who are less fortunately situated. As irrigation necessarily prevents monopoly of the soil to any large extent, compelling small holdings, as being more economical, so in like manner the products of an irrigated region preclude the use of machinery on any very extended scale, hence manual labor will always

be in great demand—not slave labor by any means, but labor in which intelligence shall be the foundation. It being granted that small holdings are a necessity in irrigated sections, and that labor-saving machinery can be used in but a very limited degree, we can never expect to see the cultivators of our lands degenerate to mere machines or automats, as every operation in connection with the soil and its productions requires the exercise of skill and judgment, and will necessarily look for a high degree of intelligence in the owner and occupier of the arid regions of our country that are going to be irrigated in the future. And we may look for a dense population and a higher degree of intelligence than has been counted necessary in the past, and the signs of the times justify us in saying that our now arid lands that are susceptible of irrigation will be the seat of a higher civilization than any that has heretofore existed on this continent.

### REPORT OF COMMITTEE ON RESOLUTIONS.

MR. GRIFFITH: The Committee on Resolutions had the pleasure of acting on the resolution introduced by Mr. Snow. Four out of five of that committee are unanimous for its adoption.

Mr. Griffith then read the following resolution offered by Mr. S. K. Snow, of Tustin:

#### RESOLUTION OF CONFIDENCE.

WHEREAS, A studied and unwarranted attack has lately been made upon the State Board of Horticulture, and particularly upon its President and Secretary, by certain persons, who, by correspondence and otherwise, seek to create the impression that the fruit growers of one section of the State are inimical to the Board and its officers; now, therefore, be it

*Resolved*, That this convention of fruit growers deplores the effort made to disturb the harmony which has heretofore existed between the Board and the fruit growers, and between the different sections of the State. That this convention emphatically denies that any antagonism exists between the Board and the fruit growers of this State, or any section thereof; but, on the contrary, declares its entire confidence in the integrity of the members of the Board, in their knowledge of horticulture, and in the impartiality with which they have discharged onerous duties. That this convention sincerely commends the Board, and especially the President and Secretary, for the untiring zeal displayed by them in fostering every interest of horticulture confided to their care, and that for the successful introduction of various parasitic insects into the State they deserve the lasting gratitude of the people of the State.

#### *To the State Fruit Growers' Convention:*

The Committee on Resolutions respectfully beg leave to report that they have considered the above and recommend its adoption, as offered by Mr. Snow. (Signed:) G. J. Griffith, Chairman; Henry A. Brainard, A. S. Chapman, J. J. Pratt, Committee on Resolutions.

On motion of Mr. MASLIN, duly seconded, the resolution was unanimously adopted.

THE CHAIRMAN: There is another resolution affecting the Nicaragua Canal. Mr. Berwick is the author of it.

The Secretary then read the following resolution:

#### RESOLUTION INDORSING THE NICARAGUA CANAL.

*Resolved*, That this convention, composed of California horticulturists, consider that the interests of the whole Pacific Coast, and of the entire American nation, demand the immediate construction, by the United States Government, of the Nicaragua Canal.

Adopted.

THE CHAIRMAN: There is another resolution, also introduced by Mr. Berwick, on the nationalization of railroads.



## RESOLUTION ON RAILROAD NATIONALIZATION.

*Resolved*, This California State Convention of Horticulturists, assembled at Los Angeles this 23d day of November, 1893, believes that the best interests of California horticulturists and of the American nation demand the nationalization of railroads.

MR. SPRAGUE: I move the resolution be adopted.

MR. FOWLER, of Fresno: Mr. Chairman, if we value human life at all, we must take another view of this question. In 1890 or in 1891, I will not be sure, there was only one killed or wounded for every twenty-four thousand that were carried—that was in France. In England, one to twenty-one thousand; Germany, one to nine thousand; in the United States, one to twenty-eight thousand, and this under private ownership. If we had the government ownership of railroads, we would have another benefit—an educational benefit—because we would have cheaper transportation for our fruits—cheaper for ourselves as well as for our fruits—from one side of the continent to the other, and the opportunity of going there and getting that education that comes from travel and association. You here in California send circulars abroad, and spend money to get people from the East to come here and enjoy the climate, buy your lands, your products, and then shall we here in Southern California say that we do not want nationalization of railroads, which would bring more people to our coast, give them larger opportunities to come?

MR. SPRAGUE: I should be very glad for this convention to make it a special order for the next session, to take it up for an indefinite time, perhaps one hour and a half, for discussion. I think such discussions are in every way desirable, but of course there is a fitness of time, and I take it we cannot do anything further with it to-night. I now desire to amend my motion by making it a special order of business for the next Convention of Horticulturists, and that the particular time be left to the Committee on Arrangements.

The motion was adopted.

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FOREST CONSERVATION.

By HON. ABBOT KINNEY, of Lamanda Park.

The importance of conservative forest policy is nowhere greater than in California.

It is now fully established, by the forest experience of France, Germany, India, Australia, etc., that judicious management will give a high and perpetual product of bark, fuel, tar, timber, etc., from the forest without injury to the forest reserve.

As great as is the value of a perennial and secure source of forest products, and as much as we may esteem the forest from a sportsman's side or regard it from the sentimental or sanitary view, it is all as nothing to its influence on the delivery of the rainfall from a country's watersheds. A forested watershed will deliver a given rainfall regularly and slowly over a long period as compared to the delivery of the same rainfall from the watershed deforested. The trees, roots, and humus detain and divide the rainfall, so that the water has time to be absorbed into the soil and rock veins. Thus, in a forested district there are none of the barrancas and gullies general in a bare country. In California we have gullies and washes in the southern section, with little forest and

small rainfall, while at Mount Shasta, with 60 to 90 inches of rainfall and a mountainous forest, these land scars are particularly absent. On a bare mountain watershed there is little opportunity for the rain to be absorbed, or for it to replenish the springs and sources of perennial water supply. Consequently the rainfall from such a district is delivered suddenly and in a short time, and we have dangerous and destructive floods. If a watershed is without forest the delivery of its rainfall is uncertain and injurious.

We are quite safe in saying that in California, as the mountains are deforested so will the perennial character of the springs and streams diminish or be lost, while on the other hand floods and torrents will increase in force and destructiveness. The water flowing regularly from the forested mountain is the aid and servant of man in his mill, house, or field. The water tearing madly over the denuded rocks of a bare and arid declivity is his scourge and his destroyer.

In the first report of the extinct Board of Forestry, a number of domestic and foreign instances are collected showing the damaging effect of undue forest denudation. Our brush of chaparral acts as a forest in delaying the delivery of the rainfall.

Some time before the abolition of the State Board of Forestry the friends of forestry in California concentrated their efforts on a national system of forestry. Colorado has gone hand in hand with us in this work, and participated in the results attained. We have achieved something important. We have secured the adoption of a policy of making forest reserves. The Federal Government has reserved large districts of land on the western mountain watersheds for the first time for forestry purposes, and called them forestry reserves. California and Colorado have been most favored in this way. In California south of Merced the most important mountain watersheds are now Government forest reserves. The Government has also taken the first step in recognizing its duty of protecting the public forest domain. The Yellowstone Reservation and the Yosemite, with its large addition, are now efficiently and cheaply guarded by small detachments of cavalry. The result of these patrols in preventing forest fires has been very marked, and has demonstrated that these wasteful and destructive forest fires were mainly due to irresponsible sheepherders. The exclusion of these herders from the Yosemite addition ended the danger from fire.

These matters all promise well for the gradual establishment of a self-sustaining, scientific forestry system for the United States. Nowhere is a conservative system of forest management more important than in a country of steep mountains alternating with fertile plains. When to this condition is added that of alternating dry and rainy seasons, under which irrigation becomes an important agency in agriculture, we have paramount reasons for a forestry system.

We may say, in a general way, that the more difficult it is to create or maintain forests on mountain watersheds, the more important these become to preserve the perennial flow of springs and streams, and to diminish or prevent floods and torrents.

The blue gum is still the most valuable addition to the forest flora of California. We have indeed demonstrated the superiority of *Eucalyptus robusta* in situations exposed to the sea influence on the one side, and the superiority of the *Eucalyptus corynocalyx* (sugar gum) in resisting drought on the other; but the blue gum is still king. Of rapid growth,

available in most of the settled districts of Southern California, quickly available for firewood, and eventually, in favorable situations, valuable as lumber, it is the tree giving the promptest results of any known in the State. It comes easily from the seed and gives the best results when planted small, and is therefore a cheap tree for forest planting. When some plantations of blue gums are made in favorable locations, say in a burned-over redwood district, or in any damp location on the Central California coast, we may expect to get trees similar in grandeur to those of Tasmania, where the blue gum often exceeds four hundred feet in height. It is not generally known that the blue gum is a close competitor for the glory of being the tallest known tree.

The introduction of insect pests, while introducing foreign plants, has been the cause of damage and injury to the State. Often this damage has far exceeded any possible benefit to be hoped for from the plant introduced. To obviate this let me suggest the advantage of adopting the policy from which I never departed in introducing foreign plants to this State; that, is by the seeds alone. I have no knowledge of any insect whatever as ever following the distribution of forest trees grown from our examined seed. Such a policy would make little difference in time, and result in much added security, not only as to forest trees, but apply to all other plants. I am decidedly opposed to the importation of nursery stock from any infected district, and I believe that every foreign district producing nursery stock should be deemed infected until proved otherwise.

The importance of forestry is a thing no Californian can afford to lose sight of. Every city, village, home, orchard, and field in Southern California is subject to damage or destruction by unwise forest denudation. Such destruction may come through diminished summer water supply, or by excessive flood delivery of water, or the creation of new torrents, as has already taken place in our section. With all our mountains bare, there is no place here that would be safe. Let us join, then, in advising our federal representatives on this vital matter.

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#### DISCUSSION ON FOREST CONSERVATION.

PROFESSOR HILGARD: Mr. Chairman, I have tried hard, both in the Legislature and elsewhere, to have considered the importance of a forest policy. Of course it is of slow growth. The American citizen knows no dearer privilege than to cut down a tree, and it is very singular, indeed, that in many districts we almost always find they are the first people to cut down a tree and then complain of the others. In regard to the trees to be planted, we have experimented already. I want to suggest one before this convention, because I do not think it is sufficiently appreciated. The eucalyptus is a fast-growing tree, but when it comes to the utilization of the wood, the fast-growing gum is a miserable failure. It is fit for firewood only, and that when cut green. I wish to urge the claims of a forest tree which in the last twelve years I have developed in this State, both by seeds and by young plants grown at the University. It is the European oak. Strange to say, the European oak is the fastest grower of its kind in our climate. One would suppose that coming from a humid climate that the tree would be shy of ours. I find, on the con-



trary, of forty kinds of oaks we have tried, that it is the only one which grows fast enough to suit our American ideas. It is the only hardwood tree that at the present time has proved to be a rapid grower in California. I think it deserves more attention than has been given to it, and I intend to propagate it extensively and to show what now can be seen on many of the private premises on the bay shores, and also in the interior: that this tree is a wonderfully rapid grower for an oak, and that it has a superior wood for constructive purposes such as we have not on this coast at the present time. It is the English oak. We have propagated it from acorns, and find no difficulty in making it grow. We find it must be planted in the spring, and in the course of the month of December it will come up and grow rapidly to about six inches, and then the top stops completely and you think that it is doing nothing. At the end of the season, however, you find it has made a root four feet long, deep down straight into the ground. I have made inquiry in Europe in regard to this peculiarity of the tree, and find that there also it does the same thing, but not to the same extent. It is noted as a tree having a long, deep root, and the proportion of six inches to four feet is a common one in California, which shows how wonderfully well it is adapted to this climate. I have now growing on top of an arid adobe hill, above the University, a number of these trees, planted partly from the acorn and partly transplanted. The trees which have been growing are about twice as high as those that have the top cut off on account of the transplanting, and the result is that one is growing straight up and forming extended trunks, which we cut off for general purposes, while the others are trying to spread out. I recommend this tree for general propagation.

MR. MASLIN: Is this English oak the same as the historic oak of England?

PROFESSOR HILGARD: Yes, sir; there are two species of oak in England—one the upland oak, sometimes called rock oak, the other the lowland oak. It is the lowland oak I speak of.

MR. MASLIN: I would like to ask if you have tried the American pecan?

PROFESSOR HILGARD: Yes, sir; the American pecan in this climate makes a better growth than the hickory. The hickory is absolutely worthless. I have tried hickory, and none of them have made a wood worth anything. The pecan is more disposed to grow slender, for some reason.

MR. MASLIN: Does it adapt itself to our climate and country?

PROFESSOR HILGARD: It seems to, yes. I will say that the pecan, being a native of the moistest climate in the United States, does not appear to be well adapted to an arid region. It belongs to the moistest and most humid portions of the United States—as you are aware, the bottoms of the Mississippi and the swamp regions of Louisiana. There is scarcely a tree imported from there, except the swamp cypress, and it is one of the most singular facts that we can grow the cypress from the Louisiana swamps on our land without irrigation. We have several growing from seedlings, and it makes a pretty fair and fast-growing tree; but I would hardly recommend it for general culture on this coast. This oak would be a tree which we may rely on to make hardwood for hoe handles, etc. We have not a tree now on the Pacific Coast which will make staves. The rapid-growing tree is necessarily a tree that has that spongy wood.

We must have patience if we want to get hardwood; we cannot raise that in a hurry.

MR. MASLIN: In the San Joaquin Valley, and in Lake County, these trees grow sometimes fifty or sixty feet to the first branch. It is a tall oak in Lake County. They claim it is a species all by itself. They are sometimes from forty to fifty or sixty feet to the first branch. They have made casks out of them up there, but that is too far off to be profitable.

PROFESSOR HILGARD: All the American species of oak, including the white, are exceedingly slow of growth. Some of our oaks make very good wood. I suppose if some of the mountain oaks were properly treated by a forester, they would make a good wood, but taking all experience together, I think the European oak is the tree upon which we can look particularly for rapid growth. There is a tree now on my premises, which is nine years old and is twenty-five feet high and ten inches in diameter.

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### THE PECAN NUT.

MR. DETRICK: Professor Hilgard, have you ever noticed the growth of the pecan in the Missouri Valley?

PROFESSOR HILGARD: In the Mississippi Valley I have, not in the Missouri Valley.

MR. DETRICK: Well, in the Missouri Valley I have seen trees apparently about seven or eight years old that were bearing nuts. Did you ever know anything about that?

PROFESSOR HILGARD: Yes; I have known that in that country; but in the Louisiana region, I know trees there in the oak region, which is considered the crack region of Louisiana, trees seven years old are expected to bear and they grow very tall. The bearing pecan tree is not a good tree to cut down. The wood is not as valuable as that of other hickories. The pecan is a hickory. It does not make a good wood; it splits easily.

MR. PARK, of Orange: Mr. Chairman, there has been some discussion about the pecan. I wish to state that we have two pecan trees at Orange that have borne for the last two years. They stand side by side by the roadway, and they have grown across. I have seen them for two years past. They have borne a very good crop of pecans. They have not made a very big growth. They stand about thirty-five feet high, and measure about eighteen inches in thickness through the main part of the tree.

MR. LELONG: Are those trees grafted or seedlings?

MR. PARK: I think they are seedling trees, from a place about a mile from Orange. I think the seeds were taken from there and planted.

MR. LELONG: The reason I ask this question is I have investigated the nut-growing trees of the State for the last two years and have found different trees planted throughout the State grown from seeds. There are a number on Mr. Chapman's place, in San Gabriel, and some in Merced County. It is well to note these facts, because there is likely to be a pecan nut so produced especially adapted to this State, and we are likely to strike something exceedingly good that will bear as the almonds do now.

MR. WILLIAMS, of San Diego: I want to ask if there has been any dif-

faculty found, or if there has been any complete efforts made, to propagate the pecan of Texas. The finest pecans known in the world are produced on the Guadalupe River in Texas, below San Antonio, and they are sold as high as \$1 a pound in the State of California when they are introduced here, and I was curious to know whether these trees would succeed here inland. It has occurred to me that there are locations here which might be very well adapted to the pecan as grown in Texas, although there may be a surplus of alkali in the soil. They grow there with the roots submerged for three or four months in water. The nuts are certainly equal to any English walnut, and, I believe, superior to it as a commercial nut. I believe, as Mr. Lelong says, that if we could find something suited to this coast, just as they have the pecan in Southern Texas, we will introduce something that, I believe, will be a dangerous competitor to the English walnut or any other nut that I have seen.

MR. DETRICK: I would like Judge Heath to tell what he knows about the pecan. I hope you will listen to him for a little, for I believe he knows more about this than anybody, and he might give us some good ideas.

JUDGE HEATH: Mr. Chairman, I have had a lot of experience in pecans. Nineteen years ago I got a seed from Texas from the location the gentleman indicates as being the most favorable to the pecan family that we knew anything of at that time. I have the trees bearing now, but slightly. They blossomed only when they were fifteen or sixteen years old. On my lands, in my walnut orchards, I have these pecans growing. The largest trees are of the height of perhaps forty feet, branching out well. I was considerably disappointed in the growth of the pecan, and especially the bearing quality. Being in the nut business, I was anxious to get other nuts, besides the English walnut, that I might make profitable and sell in the market. So, nineteen years ago I commenced that industry, and got my seeds from Texas. But it has not proved a success. Eight years ago I went to the New Orleans Exposition. I went by the southern route and stopped off at San Antonio, Texas, and examined the country. I examined the locations where the pecan grows, and my conclusions are that it is not going to do on our good farming lands; it is not going to do on the lands here in California where the English walnut thrives. I have had nineteen years' experience, and as a nut-bearing tree this is a failure. Wherever you find the pecan, it is on the river bottom next to the water, where it stands with its roots in the water. It is both in Texas and Louisiana, along the banks of the Mississippi and the Missouri Rivers. You will never find any of these trees prospering, except close alongside of the river bottom, or where the river overflows the bottom land. There they will grow luxuriously.

Now, I have been asked since I have been in Los Angeles this time, in regard to the growth of the pecan, whether they can be grown profitably for the wood. I do not think they will ever be profitable as nut-bearing trees, for the reason that the pecan does not drop its fruit. In Texas and Louisiana and along the Mississippi River bottoms, the trees are cut down or the nuts beaten off by negroes or the poor whites, and the nuts are collected in that way.

Now, the location of my farm is as free from wind as almost any location in this State. We have occasionally a little wind, but it seldom does any damage. Last winter I had one of the tops of my pecan trees,



eight inches in diameter, broken square off by a wind that did not hurt either the English walnut or the almond trees standing within one hundred feet of it. My almond trees were loaded down with fruit. So, in its young state of nineteen years old, that tree is very brittle. I have about fifty of those trees, and that tree was nineteen years old. If it can be grown profitably for wood, when it has become old enough to be hard it would be very good, but it must be planted on lines of rivers like the Sacramento, where the taproot can be constantly in the water. In Texas and Louisiana the tree stands where the water stands over it for three or four or five months in the year. No tree grows more luxuriantly under these circumstances than the oak. I found in Florida and Louisiana that the water oak grows under the same circumstances, the same as the sycamore. If I lived on the Sacramento River, up at Yolo, or up in that section of the country, where the debris would not cover up your orchards, I would run the risk of planting the pecan tree, because I do not believe it would be injured by any overflow of the Sacramento—if it is not overflowed by slickens. Of course, slickens would kill that tree, because it would deprive it of its natural moisture, and also because there is no nourishment in the debris. It might grow on some part of the San Joaquin, down below Stockton, on what we call branch rivers, on the bottoms, close in and on the soil of the adjoining land, which is overflowed at times. Here the pecan may become valuable, but you must wait a series of years before you can get the tree old enough for the wood to be of much consequence. Now, as to the pecan on the arid plains of the Sacramento or San Joaquin Rivers, between Sacramento and Stockton, and on the lands there that are what we call highlands, because they are not subject to overflow, I do not think the tree would grow at all. I think it would be of no real value, except on the river bottoms.

QUESTION: Have you ever seen the tree tried in the salt marsh, near the coast, where it would get a good deal of the saline substance?

JUDGE HEATH: I can only tell what I have observed in my travels through New Orleans. I found the pecan tree growing down in a place where the water was an overflow from the high tide. It was brackish water. That was my opinion. I saw it growing there finely. I came very near omitting to make one statement, which I will make now, because if any of you gentlemen intend to go into the raising of the pecan, there is another kind of tree that since I planted my trees I have become acquainted with, the Louisiana improved pecan, which is quite different, not of the Texas variety, and I have undertaken to raise my trees from the seeds.

PROFESSOR HILGARD: Have you ever noticed what has been complained of in the Santa Clara Valley, that the nut is scanty of kernel?

JUDGE HEATH: The fruit grown on my trees never amounted to anything. The fruit I planted was perhaps the finest I ever saw. There was no blossom on them until they were fifteen years old, and when I went, because of their tardy blossoming, to examine the nature of that tree in its native country, from what I learned then I do not believe the Texas variety is good, except you have it on the river bottom; I do not think it would ever amount to anything here in any other place.

MR. WILLIAMS: I will say this, that on the best authority—the gentleman speaks of two varieties, one from Louisiana and one from Texas—I will state again what I have noticed. I have known nuts that came

from Texas to be planted, but probably not one in ten thousand of the trees will produce that nut. It is round at the end and pale gray color, while the other is a dark nut, prone to distinct ends, and you won't find one of those trees in ten thousand. He says no transplanted tree will be a fruitful tree. You must plant the nut where you want the fruit, or else it will be an unfruitful tree. This point has been impressed upon me. I am inclined to think it is true. If I wanted to succeed, I should get the finest, light gray, round nuts, very soft shell, and plant them right where I want them. I am very sorry to hear that it is not going to be a success, and yet I would be willing to try it on that basis, putting it near the river, and giving it a good fair trial, believing that some time in the future it would be a rival to any nut-bearing tree in the place.

JUDGE HEATH: When I got my pecan seed, I did not pay any attention to this cutting the taproot, because it is the veriest humbug. I claim, any taproot tree can be cut with impunity, and if planted with care it will grow. It may not grow the first or the second year quite so fast, but if taken care of, in three years' time you cannot tell whether the taproot has been cut or not. I planted the seeds, which were shipped from Texas, and I left three of my trees standing; they are standing now. The transplanted tree, which was broken off, the larger size, blossomed before those that stood in the nursery and never were removed. I have a dozen trees that have the taproot cut. You can cut them with impunity, and if you will come to my place I will show them to you.

MR. WILLIAMS: Mr. President, I am very glad to meet the gentleman to-night, because he has settled a question that has been unsettled in my mind for a long time.

MR. LELONG: This is a very important matter to our State. I took a trip to San Antonio to look into the pecan question. When I was in New Orleans I heard of a man who had some very fine pecan trees, and I went to see them. He had about three and a quarter acres of pecans. I went through the place and they were full of fruit. He said he had grown those trees for some time, and he said that he did not think the people who got those nuts would ever make a success from their planting. He said his trees were grafted. He said that people planted the nuts, and nothing comes true from the seed. That had a great effect on me, because the nut trees that have been planted in this State have been planted from the seeds, and I know one large grove in this State planted from the seed, and in that grove you can see over twenty varieties of nuts. Now, several years ago, we planted the French variety from the seed. The trees were grown from the seed and they never bore. Near Santa Barbara, there were four hundred acres planted out. I know of a large grove in Alameda County, the owner of which tells me they do not pay. He says he has been trying to graft them over to prunes. In later years, Mr. Hatch planted a bitter almond tree, and from this almond he produced a great many varieties. From that bitter almond the finest almonds that grow in California were produced. It would be well to follow up these experiments. I have investigated as much as I can, and if there is a tree found anywhere suitable to our climate, it would be well to bud from that tree, instead of planting from the seeds.

The meeting then adjourned until Friday, at 9:30 A. M.

## XXVII.

## TRANSACTIONS OF THE FOURTH DAY.

LOS ANGELES, November 24, 1893.

Vice-President GRIFFITH in the chair.

## NEXT PLACE OF MEETING.

MR. BERWICK: I believe it is usual for this convention to meet alternately in the northern and southern districts of California. We have, in our meeting here, met the petition of Los Angeles County. I move that next year we meet in a northern county. There is nothing so beautiful in life as a path strewn with roses.

"Roses, roses, all the way, and  
Roses, roses, all the day."

So I move that we accept the invitation of Santa Rosa to meet there. This motion was seconded by Mr. Crawford, of Santa Rosa.

MR. MASLIN: Mr. President, I have the honor to nominate Sacramento as the place to hold the next annual convention of the fruit growers. It has been the custom, Mr. President, to make the circuit. About eight years ago, the City of Sacramento held the convention of fruit growers. It has made the circuit of the State—Santa Rosa, Santa Cruz, San José, Los Angeles, San Francisco, and Marysville. Some of us think it better that we should commence again where we started. Sacramento has ample hotel accommodations. It is, at present, more the seat of the fruit interests than the coast counties. There is, at the same time, Mr. President, a peculiar reason for holding the next annual convention at Sacramento. We want some legislation, and at the coming session of the Legislature there will be probably some members of the Legislature in the City of Sacramento. The State Library is there, with all its means for getting the information we want to present to the next Legislature. The capitol is at our service, as the Secretary of State has informed us. Attendants are there, and all the means for holding an agreeable session of the fruit growers. I hope I will receive a second to my motion.

The motion was seconded.

MR. BERWICK: That is the reason we want it in Santa Rosa; we are a little out of the line of the railroads. We want to get into this coöperative shipping process. We want to get the convention there, and we believe it will stimulate our people to enter into this coöperative way of shipping fruit.

JUDGE TILDEN, of Niles: Mr. President, I would suggest, as a compromise, a city between the two, and that is the City of Oakland. It is a beautiful city, plenty of halls, which will be furnished free, and all other attention given to this convention that is desirable. Then, we are near



San Francisco. If any of the members attending have any business there they can attend to it at the same time. I believe you will get a larger attendance there than at either of the other places. I hope I will hear a second.

This motion was seconded.

The question was put on the motion to meet in Oakland, and lost.

The question being put on the motion to meet in Santa Rosa, it was lost.

THE CHAIRMAN: Now we will take the question on the motion to meet in Sacramento.

The question was carried in favor of Sacramento.

#### THE "ROYAL" MESSINA LEMON.

MR. BOYD, of Riverside, entered protest on behalf of Oscar Morris, of San Bernardino, as to the conclusions arrived at by Mr. J. E. Cutter, in his essay on the Royal Messina lemon, as not being warranted by facts.

#### MOTION TO RECONSIDER.

MR. SPRAGUE moved to reconsider the vote whereby action on the resolution on railroad nationalization was referred to the next convention in order to discuss the same.

Lost.

#### THE "ORGAN" OF THE FRUIT-GROWING INTERESTS.

THE CHAIRMAN: The first order of business will be a resolution written and sent here by Colonel Otis, of the Los Angeles "Times." The Secretary will please read it.

The Secretary then read the following resolution:

WHEREAS, The fruit interests of California are among the most important of the State, in fact far exceeding those of any other one industry; and whereas, it is desirable that we should have the cordial support and coöperation of the entire press of the State, upon which the welfare of our great industry is in a measure dependent; therefore, be it

*Resolved*, That it is the sense of this convention that no particular publication, horticultural, agricultural, or otherwise, be designated as the special "organ" of the fruit-growing interests, believing that our material welfare will be better subserved by enlisting the general support of the entire press than by discriminating in favor of any class publication; and be it further

*Resolved*, That this convention recommend to all horticultural and agricultural associations of the State the adoption of the policy as outlined in the foregoing resolution.

On motion of Mr. Holman, duly seconded, the resolutions were unanimously adopted.

The Secretary then read the following:

#### REPORT OF THE COMMITTEE ON TRANSPORTATION.

After due deliberation we find that improved service and quick time are absolutely essential for the successful marketing of California's fruit crop.

As the railway companies have already signified their intention of giving fruit growers quicker time for the season of 1894, viz.: from Sacramento to Chicago, 116 to 120 hours, we ask that proportionately good time be given from all points in this State to all points in the Eastern States.

We earnestly believe that by remodeling our ventilated fruit cars to conform as near as practical to the general style of refrigerator cars, and discontinuing the use of ice, the question of rapid transit would be greatly facilitated. In remodeling these cars we would suggest that the latest and most approved system of ventilation be introduced.

Your committee believe that a very large percentage of our fruits for Eastern shipment

can be safely and successfully transported in such ventilated fruit cars without ice, saving to growers the cost of refrigerator service on three fourths of the overland shipments. In this connection we ask that the weight of refrigerator carloads be reduced from the present minimum of 24,000 pounds to 20,000 pounds. We ask for this reduction in weight, as we find it impossible to load 24,000 pounds of many varieties of fruit into a car and properly refrigerate the same.

We earnestly recommend a uniform reduction of the present freight rates on fresh fruits, knowing that a lower rate would greatly assist in wider distribution of our fruit products. We respectfully urge that the transportation companies take prompt action, with a view of insuring quicker time and better service for the movement of the fruit crop of 1894. We further ask that such special service be performed by the railway companies at a minimum rate of freight not in excess of the present rate of \$1 25 per 100 pounds to Chicago and common points.

H. P. STABLER, Yuba City, Chairman.

C. W. REED, Sacramento.

I. H. THOMAS, Visalia.

A. SCOTT CHAPMAN, San Gabriel.

NATHAN W. BLANCHARD, Santa Paula.

MR. PATTON: Mr. Chairman, I desire to offer an amendment to that resolution, as follows:

That the railroad companies, in simple justice to the fruit growers of California, should reduce the rate on oranges from 87½ cents to 50 cents a box to Chicago.

Adopted.

The report was then adopted as amended.

MR. MASLIN then read the following:

#### REPORT OF THE COMMITTEE ON LEGISLATION.

Your committee report that it has considered the annual address of the President and report that the President recommends:

*First*—A bureau of statistics.

*Second*—An appropriation for the importation of predaceous insects.

*Third*—A vagrant law.

A resolution has been passed requesting the Legislature to appropriate a sum of money for the importation of insects beneficial to fruit culture.

The committee has not had the time to prepare the laws embracing the subject of bureau of statistics, and recommend that a committee be appointed to prepare such laws and report the same to the next fruit growers' convention. If time does not allow the selection of a committee, this committee will take upon itself the task of preparing the laws.

E. W. MASLIN, Chairman.

R. C. KELLS.

J. F. McINTYRE.

MR. BERWICK moved to amend the report by recommending to the fruit growers of California the careful study and consideration of the nationalization of railroads.

This motion was seconded.

MR. MASLIN: Mr. President, you cannot amend the report of a committee; you can submit that again to the committee.

[At this point President Cooper entered the meeting, and took the chair. Applause.]

The amendment offered by Mr. Berwick was adopted, and the report of the committee as amended was then unanimously adopted.

#### REPORT ON PRESIDENT'S ADDRESS.

MR. HOLMAN: Mr. President, I have a brief report from the committee of which I am a member, appointed to consider the address of President Ellwood Cooper, and we have to report, by your pleasure, as follows:

Your committee to which was referred the address of President Ellwood Cooper beg leave to report:

*First*—That the report as a whole be adopted.

*Second*—Since the transportation, legislation, and other committees have treated the specific suggestions in Mr. Cooper's report, we shall limit our suggestions to the recommendation that a committee be appointed to consider the question of establishing a permanent bureau to send out expeditions to every part of the world to investigate parasites and fungoids, and we recommend that its committee be instructed to report a full statement of facts relative to matters, with suggestions for permanent organization, and as to ways and means, to the next fruit growers' convention.

ABBOT KINNEY.  
E. BOUTON.  
ALFRED HOLMAN.

MR. HOLMAN, continuing: The other matters as to legislation have been so fully covered by the report of Mr. Maslin's committee, that we have felt it would not be necessary for us to meet with them.

The report read by Mr. Holman was, on motion, unanimously adopted.

MR. SPRAGUE: If I voice the general sentiment of the convention, I should be very glad if we could provide for a "general discussion" at the next session, and possibly the best way would be by a question-box. You are all familiar with that. Questions may be placed in it, pertaining to practical matters of the orchard, and those questions may be taken up, in any way the Chair may decide, and discussed briefly during that session of the convention.

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### POLLENIZATION.

MR. BERRY: Part of the business of this convention was in regard to the proper fertilization, but the question of the pollenization of the blossoms of the fruit trees was not entered upon at all. I therefore wish to quote an experiment that I have been making, for the last year, at my own orchard. There was a French prune orchard in Tulare County, where the trees grew very well, and became seven or eight years old, and are not bearing fruit. I found that the owner had no neighbors who kept bees. He had planted all of one variety of trees, which was the French prune. I suggested to him that perhaps the French prune did not pollenize. Like a great many other people, he was disposed to laugh. He concluded to try the bee proposition, and introduced several colonies of bees, and this last year was the first year that he had any fruit on his trees. At the same time I, myself, was doubtful whether the experiment would be a good one, but to test my own theory—I was surrounded with bees—I wrapped up some of the limbs on Bartlett pear trees; isolated them from coming in contact with the bees. I isolated the limbs so that the blossoms could not be pollenized by the bees, and gentlemen, on those limbs, and on trees that were prevented from being used by the bees, I had no fruit whatever.

Another case: In our district there is a gentleman, a fruit grower, named Mr. Anderson, who has a twenty-acre orchard, with which he is very successful, because he gives it his personal attention. Mr. Anderson planted on one side of his orchard a row of French prune trees. Those trees stood there until this year, which will be the ninth year; and during the third, fourth, fifth, sixth, and seventh years they had borne no fruit. A few years ago Mr. Anderson planted a row directly alongside of these, of Silver prunes, and the French prunes bore fruit as



soon as the Silver prunes bore fruit, and not before, showing that there was a distinct pollenization of the blossoms between the two trees.

In regard to pears, I have planted other pears alongside of the Bartlett, and wherever those have been planted I have had a crop; wherever the Bartlett stood isolated, I had none at all. You can consider these matters when you go home; you can make your own experiments; that has been my experience.

MR. SPRAGUE: Have you had any experience in that line with apricots?

MR. BERRY: No; I have not tested that with apricots, but probably it would result in the same way.

MR. BERWICK: Mr. Chairman, I had a similar experience with English filberts. They grew very nicely, but did not bear, and do not bear, and the reason is simply that the male blossom comes out in the fall very well, but the female blossom does not expand till spring. The male bloom is earlier; it falls off and dries up before the other blossoms are developed.

MR. BRAINARD: In regard to filberts, they are not very much cultivated; at the same time it is desirable to cultivate them. From experiments made by me, the filbert, when allowed to grow in the bush form, its natural shape, does not bear at all. We had bushes that did not bear half a dozen nuts. In every instance, when it was trained into the form of a tree, it bore heavily, and this, so the gentleman who owned the trees told me, had continued for several years, so that he was still sure of the value of that style of pruning.

#### APPOINTMENT OF COMMITTEE.

THE CHAIRMAN (Mr. Griffith): I now appoint as a committee to carry out the plans that were suggested in President Cooper's address, touching upon parasites, the following: Ellwood Cooper, of Santa Barbara; William Johnston, of Sacramento; Abbot Kinney, of Lamanda Park; S. F. Leib, of San José; General N. P. Chipman, of Red Bluff.

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#### DISCUSSION ON ORCHARD CULTIVATION.

MR. SPRAGUE: If it is not desired to adjourn before 12 o'clock, which is our custom, and if there is nothing before the convention, I would like to raise a question concerning the cultivation of orchards. There have been in most orchards, in years past, differences of opinion regarding the necessity for deep cultivation. I would like to know the experience of those present in this respect. Of course I know there are differences in soils, which must be regarded, but as a general statement where the soils are moderately close, simply decomposed granite, so common in Southern California, whether it is the opinion of the horticulturists present, that—aside from the matter of weeds, which must, of course, be kept down—whether it is best to run your cultivator a little deeper, in order to get down to moist ground each time; or whether, providing the surface is thoroughly pulverized for a distance of two or three inches, that is sufficient to prevent such evaporation of moisture as comes from capillary action, where the surface is allowed to become hard. I would like Mr. Thompson to speak on this.

MR. THOMPSON: Mr. Chairman, as to whether it is desirable to cultivate orchards in the spring, and to plow deeper, in the absence of irrigation, I say, get down to where the earth is moist. In order to save the moisture from the air, it is sufficient to keep the surface thoroughly pulverized within a distance of two or three inches. I have never seen any very successful results from shallow cultivation. I recommend thorough and deep cultivation, especially at the last of the season. At the time when our last rains occur, or directly after our last rains—we cannot always tell when our last rains come—I would advise thorough and deep plowing. There is a great deal of winter cultivation that might be avoided, but it is advisable to keep up a thorough cultivation, not necessarily so deep in the early part of the season, but late in the season it should be deep and thorough.

MR. SPRAGUE: My questions refer to July and August cultivation.

MR. THOMPSON: I have never been in the habit of cultivating in July and August. I never cultivate later than the first of June.

MR. SPRAGUE: Do you have any weeds after that?

MR. THOMPSON: I handle them with a large weed cutter. As late as the first of July, our ground is thoroughly pulverized. I do not think cultivation after that is any advantage.

MR. SPRAGUE: If cultivation is the savior of moisture, why not cultivate all summer?

MR. THOMPSON: I believe that as you stir up the ground and expose it to the heat, you lose some of the moisture.

D. E. SMITH, of Santa Ana: I understand Mr. Sprague wanted to know if, after you have made a deep cultivation, a thorough pulverization, whether the next time you should go down still deeper, and loosen up more soil, and I think you should not.

MR. THOMPSON: I certainly would not.

MR. SMITH: You want to make the cultivation deep enough to produce a layer of loose soil on the surface, and no matter how deep we make that cultivation, if it is a thorough cultivation of the soil which is loose, it will dry out down to the bottom. It wants to be a sufficient deepening to prevent this evaporation. After you go that deep it would be a waste of time to go lower.

MR. THOMPSON: Did I understand you to say that if your mulching is deep it will dry out?

MR. SMITH: Unless it is deeper than anything I have ever seen.

MR. THOMPSON: If you have a good, loose surface of a foot deep, I know it will not dry out to the depth of that foot. If the ground is thoroughly in shape, it seems to me that continually stirring that soil is an advantage.

MR. SPRAGUE: He is trying to state what I tried to state. I seem to have not made myself clear. Is it desirable, in summer cultivation—I will say the latter part of June, July, and August—to cultivate the surface of the ground at all, in the absence of weeds, providing there has been suitable preparation of the ground in the early part of the season? If it is desirable to cultivate at all, must it be cultivated so that at each succeeding cultivation the ground will be stirred more deeply?

MR. SMITH: I understood Mr. Thompson to answer this in the negative; that it was not desirable to cultivate at all during the dry summer, providing you have no weeds, and, consequently, if it should be considered desirable to cultivate at all, it was not best to cultivate deeply.

MR. THOMPSON: If your soil has been properly cared for.

JUDGE TILDEN: I have seen places worked side by side, and each owner would plow the land and cultivate it in the spring, so that when the rains ceased the land was alike, mellow. One would stop there with the work, but the other would keep on during the months of June and July and until the commencement of the packing of the fruit, and I noticed the one that kept on cultivating got the best fruit of the same variety. Take peaches, for instance; you get the largest peaches; they bring more in the market. I noticed the same fact with apricots and other fruits. I have noticed that those who plow deep and pulverize well get better fruit, right side by side with those who plow shallow, where they both keep on cultivating.

PROFESSOR WOODBRIDGE: This brings up the whole question of green crops. The gentleman has spoken of cultivating for the purpose of keeping the weeds out. Now, these weeds, and all kinds of grass, are great nitrogen producers, and take certain kinds of food from the soil, and if they are turned in in time they are in more soluble condition than later. Every time you turn the soil in, you loosen it up, expose new surface to the air, and the moisture is again started afresh; insoluble plant foods become soluble plant foods, so that the plant can take them up. Now, can you decide whether it is best to cultivate often? You might make comparison between the orchards I have in mind. They were originally one orchard, and they were the Navel orchards of Southern California. One of these gentlemen plows his orchard twice a year so deeply that he breaks off many of his little surface roots. Every time a root of that kind is broken off, it sends out four, five, or may be six more roots, which roots are feeders. He fertilizes his orchard continually with stable manure. Of course, the manure is full of seeds, which sprout, and you will see a little green cropping up all the while. That is plowed under. This gentleman got from his orchard last year as much as nine boxes of oranges more than ever before, and he has got a larger crop than the preceding year. His next-door neighbor, who does not fertilize and does not put on any green crop, does not have as large a crop as he does.

MR. SPRAGUE: The discussion must certainly be divided and kept solely to the non-irrigated sections and non-irrigated fruits. The method you mention would not do in the irrigated section, because the weeds would grow too fast and form an obstruction on the surface.

PROFESSOR WOODBRIDGE: Citrus fruit trees are apt to have off years. When such is the case, as soon as the tree is through its bearing and the fruit is packed, it is well to start the green crop and let it grow up, turning it under during the winter season when the tree is doing nothing, and the next year the blossom is more apt to set.

MR. SPRAGUE: It would seem to be desirable to know what we are going to do this afternoon. I move you that the general work here be considered in order for discussion this evening, and by way of giving definite form to this, that a question-box be arranged, so that questions which are placed there can be answered promptly.

This motion was carried.

On motion, the meeting then adjourned until 7:30 P. M., at the Chamber of Commerce.



## XXVIII.

## EVENING SESSION.

The meeting was called to order at 7:45 P. M. by Vice-President GRIF-FITH, who took the chair.

THE CHAIRMAN: The last resolution offered and adopted before we adjourned this morning was to the effect that there should be questions asked and answered upon the various matters. Those who have questions to ask bearing upon any subject will please send them up to the table and we shall be glad to give them full consideration. There is plenty of paper here for those who desire to write questions.

MR. BERWICK: While the questions are being collected, I wish to move regarding the Nicaragua Canal resolution; that the Secretary be directed to forward the resolution to all our members of Congress.

The motion was carried.

## THINNING FRUIT.

MR. KELLS: I am glad this subject has come up before the convention is closed. It is an important subject, but it is a subject too large and of too uncertain a quantity for a person to write on without much consideration. So, I think by opening the subject in this way, it will be of much more interest and more to the point than if conducted on paper. I will confine myself to deciduous fruits, which are about the main fruits that are grown in the Sacramento Valley. Where I live, in Sutter County, we grow mostly peaches, prunes, and apricots. We commence our thinning about the time the peaches are the size of a small marble, and we really do not adhere to any particular rule. We size up our trees, as you might say, as to the condition of the tree, the age of the tree to some extent, and about how much fruit this tree will be able to carry and produce good, large fruit. We will say a tree that is three years old, which is the third crop of the peach tree, we do not want it to bear a great deal of fruit, and we pick off nearly all the fruit on the tree; at least, after thinning, it seems as though nearly all the fruit had been picked off. As the tree gets older and the roots get deeper into the ground, and as it tends to draw on the moisture better, and has a larger output of wood, and the wood is more matured, we leave the fruit thicker, and we begin to thin our peaches about four to six inches apart. When we say four to six inches apart, we do not mean two inches apart. The average thinner, when he gets through thinning peaches four inches apart, will leave them really two inches apart. So we lay down a rule of eight inches, and then we find they thin to about four inches. We try to thin our peaches so that they are on the main branches of the tree particularly, and not on the minor limbs or twigs of the limb. It is where the peaches set most heavily, on the light, lower limbs, and they want to be picked off pretty thoroughly. We had Senator Buck at our horticultural show in Sutter County one time, and we tried to have him explain how he would do the thing, and he told us that he expected to have his tree produce four boxes of peaches, and he would try to distribute the peaches on that tree so that it would produce four times eighty, or say 400 peaches, and by distributing that amount of peaches over a tree that would only produce twice that amount, you would get that many peaches of good size, and the tree would stand the load without breaking

the limbs, and produce new fruit wood for the next year. It would be in good condition from year to year, carrying the fruit in that manner. I think many of us make a mistake by letting our young trees overbear in the first two or three years, from the fact that the tree is unable to produce new fruit wood for the coming year. If we leave the fruit on, the fruit is very small and inferior and is only fit for drying, canning, or shipping. We thin, largely for the purpose of canning fruit, and the canneries in our valley do not can anything less than two and a half inches in diameter. So, when you thin peaches four inches apart—where they are not four inches apart, they touch one another when they are full size—so that although four inches may seem a good ways apart when the peaches are the size of a small marble, you can readily see that a tree would carry a load distributed all over the tree. Eight inches comes nearer the rule than four inches. There is no definite rule. I think we must gauge the thinning by the condition and size of the tree generally. I do not remember the rule of thinning plums or prunes in our valley or in Northern California. So far as I know, we do not thin apricots to any extent, but where the principle has been put in action, I find it has paid the grower well. When we have a heavy crop of apricots, and they set in clusters, I think a man ought to thin them. I do not know what else I could present on this subject at this time. I am better at answering questions than I am at putting them, and if any one present would like to ask questions from a practical standpoint, I think I can answer them, perhaps, and answer them from personal experience and from successful experience.

MR. BERRY: Mr. Kells, in giving your instructions to your men to thin your fruit, do you specify that they shall select the best possible specimens on the limbs, where they can conveniently do so, or do you make any material difference in the selection?

MR. KELLS: I invariably instruct them to select the best fruit. We sometimes have to pick off some that seems as though they should be left, when there is another peach near by that seems to be a well-developed peach. In that case, that is the peach I would rather have left, and I instruct our help to work in that manner. We try to keep our fruit within the center of the tree as much as possible, and not get it on the ends of the limbs.

MR. BERRY: Have you sometimes found, where you have to thin twice, and you have got the time, or the tree has become in consequence of thinning the first time too heavily loaded, and the stone in the peach has become too hard, that you are benefited by the thinning at that time?

MR. KELLS: Yes, sir; you had better take them off the tree than to try to mature them and make a crop. I have been thinning for a number of years, and I have never gone over a peach orchard and been satisfied with one thinning. At certain periods I have gone over them and thinned them three times, in order to get them as thin as I want. Sometimes in the first going over you think you have them thoroughly thinned. If I was crowded with my work and found my peaches were too thick after the pits were hardened, I would pick them off afterwards.

MR. SILVEY, of Monterey: I would like to ask the gentleman if he irrigates?

MR. KELLS: No, sir.

MR. SILVEY: Then you do not know, in case you do not irrigate, what the condition is where you do irrigate.

MR. KELLS: I think where they irrigate in Placer County, they thin more thoroughly and try to get a large fruit. They thin with a view to getting a good sized fruit, and preserving the tree for another crop. It is a bad policy to let a tree produce a great crop, with the expectation of making a sum of money in one year. You must provide something to carry that tree along for the years to come, in order to make money out of peaches or apricots.

THE CHAIRMAN: The Chair might ask one question on the subject, as he has some of those trees. If there was a light crop, would it be advisable to thin them, or do you confine your thinning especially to a heavy crop?

MR. KELLS: I will say, Mr. Chairman, that it will depend something on how light it was after we get through thinning. Sometimes, after the first thinning, the peach being very small, we do not think there is anything left on the trees. A stranger would look into the tree and would not see the fruit, because the foliage will, to some extent, cover them, and he would think it was a very light crop. I think when peaches are first setting, it would pay a man to go over them and thin them, because he would have more of them than he thought for. If a tree is in a condition that it sets very light, it is not in condition to carry a very heavy crop anyhow, and they should be very thin, so that it would carry the load through and propagate for another year.

QUESTION: Take Silver prunes and Egg plums—that class of fruit—how do you generally thin them?

MR. KELLS: Well, we do not thin plums and prunes. But since you speak of it, we have thinned a good many Hungarian prunes, and I make it a rule to thin mine something after the style of peaches. We thin them down to four inches. We take off the double ones and thin down to not less than four inches. A man thinning will always crowd on the space of four inches and get to thinning to half the distance that you have laid down.

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## IRRIGATION AND CULTIVATION.

MRS. JONES then read the next question, as follows: "What are the methods of irrigating and cultivating orchards in Central and Northern California?"

MR. ADAMS: Mr. President, in the Santa Clara Valley they irrigate in winter. The streams in the Santa Clara Valley do not retain their water for summer irrigation. The rainfall is quite heavy in the winter time, and they endeavor to irrigate thoroughly in the winter, so as to insure the ground a thorough soaking. They continue that at reasonable intervals, as long as they have water, and then they stop. Now, there are some few farms in the Santa Clara Valley irrigated in the summer, but it is by artesian wells, or where they are situated so that the water can be pumped up. There is no flowing water there anywhere for summer irrigation.

MR. SPRAGUE: Would they not irrigate heavier and later if they could get the water?

MR. ADAMS: I think they would. Of course, it depends on the crop. It is a question what they would do.

MR. SPRAGUE: How were the peaches and apricots?



MR. ADAMS: Well, they are inclined to fill out with water; so with cherries—they like to fill them up with water before they ship them.

MR. SPRAGUE: If they dry the fruit, how much more irrigated fruit does it take to make a pound of dried fruit?

MR. ADAMS: We are experimenting with that. In our coöperative concern there is a great disposition to put irrigated fruit in with unirrigated fruit, where it all goes into a pool together. Those who do not irrigate are not willing to put a given number of green pounds against a given number of irrigated pounds. It is evident it shrinks more, and many think it shrinks so much more they are unwilling to stand the risk. That is one of the sources of friction in our coöperative organization. As irrigation increases there is more and more tendency to separate the irrigated from the non-irrigated fruit.

MR. BERRY: I have had some experience in our county. Take peaches in Tulare County irrigated in the spring and winter, and the difference between irrigated fruit and fruit not irrigated is an average of two and a quarter pounds.

MR. ADAMS: In Santa Clara County we say it takes five and one half pounds to one.

MR. SPRAGUE: What is the best early peach to dry? The Foster?

MR. BERRY: The Foster is one of the best. While there has been a great deal of row about the Muir, I do not like it. The wood is extremely brittle. The peach ripens in one or two days, and if not properly cared for will rot before we can get it off the trees. Our next variety would be the Late Crawford, which is a far better peach than the Early Crawford. When it comes to eating, naturally no peach exceeds the Early Crawford. We have two varieties of Orange Clings, and after them comes the Salway, for drying.

MR. HUDSON: Mr. President, I have been drying peaches for some little time. We irrigate in our part of the country. We do not water, we irrigate, and we irrigate very thoroughly; that is, I do. I irrigate in winter all over my land, at from four to eight inches in depth. I hold the water there from one to four days. After the peaches and nectarines are set, I flood again. I also plow both ways and cultivate both ways and harrow both ways. Then, I am not satisfied with that, but I hoe. That is the way I commence. Now, the question is whether you can dry fruit that is irrigated in that way. Santa Clara County will say we cannot, and other counties will say they cannot and they also think they can raise fruit; that it only takes four and five and six pounds of fruit to make one pound of dried fruit. Now, to get at the exact amount that it takes. I have weighed, for three years, every pound of fruit I have dried, and I have dried from twenty-five to forty-five tons each year. I found after all this irrigation, and I have flooded from one to four times every year, that I always had a good crop. I have always thinned closely and always pruned closely, but when I came to weigh up I find it takes six and three fourths pounds of peaches of all kinds to make one pound of dried fruit, and if you can irrigate, or find any one who irrigates any more thoroughly than I do, I want to see him. I am on sandy land. That makes some difference. My land is principally sand. I experimented with white nectarines two years ago. I did not irrigate them at all, nor let a drop of water on them. This year I flooded them twice thoroughly and there is very little difference in the crop. That is my experience.

Now as to prunes. I flooded my prunes this year four times. I have only a few—147 trees. Those trees averaged me 310 pounds to the tree. I sold them at  $4\frac{1}{2}$  cents a pound. They paid me \$754. It took less than three pounds of prunes to make a pound dried, and they averaged seventy to the pound. We have so few that we do not grade them. I am strongly in favor of irrigating, or flooding heavily, all the tree fruits. Now, I want to say that about five years ago there was such a feeling in the northern part of the State that they would not buy our fruit and would not take it. I had some pears, and Mr. Lewis, a neighbor of mine, said that there was a cannery at Los Gatos, and that they wanted my pears. I sent them up there and did not hear from them for some time. They had always said the pears would not keep. I went up there and found every one of the pears in the boxes. They said that they did not can them because the fruit was keeping all right, and that they were compelled to can pears that had come in since which were irrigated, whereas mine were not irrigated. Now then, it seems to me that when we come to look into the history of this thing, you cannot guess at it; you have got to weigh every pound, and I do not think that irrigation is such a great detriment to the fruit. I know it is not to the size; I do not think it is to the quality. My land is getting pretty well sub-irrigated now, and I would like to hear from any one that has tried the plan of weighing and knows just what he is doing the entire year, and can tell whether the unirrigated peach is so much superior to the irrigated.

MR. MASLIN: Mr. President, I want to correct any impression that our Southern brethren have that there is any regular system of irrigation in Northern California. You can see, from the formation of the country and the rainfall, that there would not be any regular system. For instance, take Red Bluff and Shasta. I give Shasta City, where the rainfall is 100 inches for the year. Then come down to Red Bluff, where the rainfall is about 30 inches; at Sacramento the average rainfall in 20 inches, and then the rainfall increases at the rate of one inch for every one hundred feet of altitude. Colusa, Sutter, and Sacramento Counties do not irrigate, and Shasta and Tehama irrigate freely, so there is not much irrigation practiced in Northern California. In Placer County, with which I am somewhat familiar, we do not winter irrigate. If I could have my way, we would winter irrigate. We depend on ditch water, for which we pay a price. That water is brought from the ditch, put in the reservoir, and irrigation does not begin until late in the spring. Pruning is begun sometimes in November and sometimes in April, depending whether a man is afraid of frost or not. There is not much irrigation until the fruit begins to make its seed, or swell, and then there is what they call a copious irrigation, but which, in the San Joaquin Valley, would not be called copious irrigation. That depends upon the power of the soil to absorb moisture in the winter time. The granitic soil—the absorbing power not being great, the soil being five or eight feet deep—requires great irrigation. In the light soil, which absorbs moisture in the winter time—the rainfall is about 40 inches—there is not so much need of irrigation. Every man is a law unto himself. As to the system pursued, it is the basin system. I do not think that I ever saw the Riverside system practiced in any part of Northern California. The water is taken from a reservoir and it is carried down, sometimes by runs, one on each side of the tree, sometimes between the

trees; but they do not construct those ditches so that there is any regular system of irrigation.

MR. MOSHER: I think that it makes a great deal of difference how the fruit is dried. In peaches, before they are thoroughly dried (that is, dried up hard), if they are put in a place where they will dry slowly, they will not dry out so much. That will make quite a difference. And then it makes quite a difference how ripe they are when picked. You know that the riper the fruit is when picked, the more sugar there is. All these things it is necessary to watch. I believe in irrigation, and after irrigation, cultivation. The heavier the soil the more cultivation. That is my experience, and I think that we cannot cultivate too much. We claim to till our land as late in the season as we can, before the summer is entirely gone, and turn under the weeds as much as we can so as to get all the humus. We cultivate with cultivators that will not turn the soil to the air only enough to keep up the circulation. In San José, I buy largely of prunes, and when I can I purchase irrigated prunes, which have been carefully and thoroughly irrigated. I prefer the irrigated prunes in the Santa Clara Valley, because they are larger and finer. They drop more evenly from the tree. If the ground is not cultivated, the tree suffers from a lack of cultivation or a lack of irrigation, and the prune is apt to hang on the tree. When you see a prune hanging to the tree or some dropping off before they are ripe, there is something the matter. There are three things that we must more thoroughly understand, and they are cultivation, irrigation, and fertilization, and the more irrigation the more cultivation. Now, we never need to irrigate after May. We aim to do our last irrigation about May. If we irrigate later than that the prunes are apt to fill out too fast and then crack open. For instance, apricots, when they are not irrigated, and the warm weather comes on, there is a time just before they get ripe when they seem to fill out. The last week probably they grow very much faster. They are really filling out, and turning the different chemicals of the apricots into sugar. If there is not enough moisture in the ground to do this, and the hot weather comes on, they dry on the tree and get hard. They are not usually as rich. But, if thoroughly irrigated at the proper time, this does not seem to happen.

JUDGE TILDEN: Mr. President, I have been very much entertained in hearing this discussion in regard to irrigation. In my vicinity, in Alameda County, there is quite a disagreement among the fruit growers as to the desirability of irrigating. There we have the deep alluvial soil fifteen to twenty-five feet deep. We come down to gravel, and, of course, it will retain a great deal of moisture. While we have no general system of irrigating, we have an irrigating ditch from Alameda Creek, running out several miles, for three or four miles, furnishing irrigation. This they claim is a great benefit, although some of them claim that it does no good. They say it is an injury. Our land, which they claim is level, is not exactly level; it is, of course, a little rolling. Looking over it with the eye, you would say that it was level, and if you surveyed it you would not find from six inches to a foot difference in ten or twenty rods. Therefore, we lay it off in blocks, usually about forty feet, and then we run the water on, and that is the way I do and so do all my neighbors. We run the water on, and we calculate to put on about six to eight inches depth of water; ten to twelve inches I have put on. Of course, we do not measure it accurately. I have put on twelve inches of water, so that



the ground is thoroughly soaked. If you happen to step on it, you will go down so that you want some one to pull you up. In the winter the ground is soft. Of course, where we irrigate in winter, as soon as it is dry enough to plow and the weather is suitable, we plow at once and cultivate, and bring it into a fine state of cultivation and keep it so. We do not irrigate, then, any more. In doing that we get very good peaches—large enough for our canneries;  $2\frac{1}{2}$  inches is the size the canneries require, and as high as  $2\frac{1}{2}$  inches. I have for several years sold my peaches to the canneries, and I had no trouble as to the size. Generally, before they irrigate, they plow the land, get it in very good condition; then some let the water run in ditches. They plow two or three ditches each way and let the water run through, and fill these up two or three times. The land is pretty well soaked. Then they get a good crop. Within the last two or three years, one or two commenced by pumping the water. They wait until the second crop, after the pit is formed, and then they plow ditches through the orchard on each side of the trees, and then they pump the water through the ditches and let it run through on both sides of the trees. They do that after the pit is formed and the second growth commences, probably two or three months before the peach is ripe, and they get good peaches whenever they do that. They also get fair peaches without irrigating at all, except it is a very dry year, when the peaches are small.

MR. KELLS: I have followed Mr. Hatch's plan to a great extent and have become a convert to that method of cultivating orchards. His method is to plow early in the spring, and to cultivate from the time he first plows, every ten days or two weeks. He thoroughly cultivates from the first of May until the middle of August. I would like to say that I got my style of cultivation largely from Professor Wickson, three years ago. The reason I made a point of cultivating a little deeper every time I cultivated, was from the fact that Professor Wickson suggested the idea himself, or at least that was the conclusion he had arrived at at that time. When we cultivate about the same depth each time, we form a casing between the moist land and the mulching, and the idea was to break that casing every time we cultivated, to give the moisture a chance to rise.

MR. SPRAGUE: That was the theory upon which I proceeded last year, as did also neighbors of mine. This year we have taken another course, plowing deep in the spring, with a deep cultivation following while the land is moist, and then following with the harrow and weed cultivator. After a rainfall of only 11 inches, in August and September you could go over that ranch and with the toe of your boot find moist soil almost anywhere. That is our experience. The trees are one or two years old. As compared with the result last year, it ought to be pretty nearly the same.

MR. BERWICK: There is very little draught from a tree two years old.

MR. SPRAGUE: It is to prevent the evaporation that this cultivation is made, and my relation of this matter is to show that, as nearly as I can read it, we did not gain anything by the deeper cultivation last year.

MR. BERWICK: But the evaporation later on is by exhalation from the trees when they are in full growth.

MR. KELLS: I would like to make a correction. When I spoke of the Rio Bonito orchard, I spoke of his method of cultivation. I referred to the result of his cultivation in Placer County, which is foothill land,

while, of course, we all know that the land at Rio Bonito does not require the amount of cultivation that land does at his Placer County ranch, or his Yolo or Suisun ranch.

MR. BERRY: In my ranch I have adopted a system of cultivation. I use a 44-inch, reversible disk harrow, 8 feet wide. I do not plow at all. I use that harrow after the rain. We only have an average of  $8\frac{1}{2}$  inches of rain. The water-level is 7 feet deep, and in the winter time 5 feet deep.

MR. SPRAGUE: That makes an entirely different condition.

MR. BERRY: I want to get down to the cheapness of cultivation, which I get with an 8-foot, 44-inch disk harrow. When we first started we could not get that reversible, and they had a tendency to till the ground by reversing. You can keep the ground in good shape putting four horses abreast and one man to drive. As the trees grow larger, of course you cannot get through the row. I am able to conduct that ranch, so far as the care and attention to the trees, consisting of peaches and prunes, 440 acres, by an average expenditure of the labor of two white men and two Chinamen. That does not include pruning or the picking of the fruit. I mean the cultivation and the necessary care of the trees. I think I have got it down as close as anybody can get it down, in regard to the expenses on a place of that size. I did not put any weights on this 44-inch disk harrow in the beginning, but gradually I commenced adding weights to it. It has been my aim to get over the ranch with this disk harrow about once every fourteen days. Sometimes it is not exactly, but I aim to do that, and I roll over every weed that grows. I have found, so far as that county is concerned, it has been the most economical plan I have ever pursued.

MR. MOSHER: Why do we cultivate? We cultivate to get a circulation of air through the ground. It is to loosen the ground so that we can get a circulation of air. It helps to fertilize the soil. Now, what is it that causes our trees to die of sour sap? Isn't it caused by water settling around our trees and making the ground soggy?

MR. SPRAGUE: Not where we have 11 inches of rain. In new sandy soil, of course, there is a circulation. Now, I think every one that has an orchard has an experiment station. I have an orchard, and I know it has been very much more experimental than remunerative to me.

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#### DESTROYING GOPHERS.

MRS. JONES then read the next question, as follows: "What poisons have been most successful with gophers?"

JUDGE TILDEN: I have found strychnine the best thing we can use for gophers. Those who have much work to do usually take carrots and slice them up. Have a man sit down and prepare a quart or two quarts—it depends upon the land to be gone over. Then put a little strychnine in each piece with a knife. We find we have to dig down; do not put it in the hole. If we put the piece of carrot in the hole it seems to be thrown out. If in the summer, by striking around the hole with a pick, you find the main hole, and then throw in two or three pieces of carrot with poison on them, which you cover up, it is very seldom the gophers will be seen in that place again. When I went onto my old place it was full of holes. I believe in going through the orchard

about every ten feet you would step into a gopher hole. The ground was honey-combed with them, and in a little while I got rid of them.

MR. BARRY, of Alameda County: Have you found that irrigation did a great deal to get rid of the gophers?

JUDGE TILDEN: Irrigation would, of course, if the water stands, tend to kill them off, but many of my neighbors do not irrigate, and raise a large crop of gophers. I told my men that whenever they found indications of a gopher to stop and poison him, and I make it a rule to have green carrots the year around by setting them out in the garden at different times. It did not take many, of course—one or two carrots at a time. Whenever you find a gopher hole, go and poison that gopher, and I think if my neighbors were all as careful as I am, we would not have many gophers. Another trouble: they will get under the road, and we have to go along by the side of the road. Some of my neighbors have tried bi-carbonate sulphide, and say that it works very well for awhile. There are other poisons, but with the use of strychnine there is very little trouble in keeping the gophers down.

MR. MOSHER: I have a very good remedy for killing gophers. It has been very effective and is very simple. I take a quantity of prunes—we have them always on hand, so that when we see a gopher hole we attend to it right away. We open them and take the pit out, being very careful not to touch them with our fingers. We take one up with the point of a knife and take as much strychnine as will remain on the end of a penknife and put it in the prune. We have a number of old sticks, about the size of a leadpencil, with which we pin the prune together. We have an old pail full of these sticks. Whenever we see a gopher commence digging, we go and put these sticks in the hole. The reason for putting this stick in the hole is, if you put the prune in alone, the gopher digs it out. The gopher is very fond of prunes, and we get them every time. Another thing: we always know whether they eat the prune or not, because there is the stick to show.

A MEMBER: This season I have noticed in the drying-ground that they have even come up and gnawed through the dried apricots. Late in the season, when the apricots were perfectly ripe, I have placed them on a tray for the purpose of sprinkling them with strychnine, and we can kill them every time with it. In the spring of the year, when you find a gopher hole open, if you put a little strychnine in that hole, it will kill them. You must understand their habits. I find that in using the apricots, I can dry them and put them away in tin boxes, and they are available at all times.

MR. BARRY: Mr. President, I take a young malva, split it with my knife along the thick branch, leave the leaves on top, put the knife in the strychnine and put a little of it on the leaf, and put that in the hole. During the whole time I have tried it I have never failed to kill the gopher.

THE CHAIRMAN: I have a way of getting rid of them without strychnine. A gentleman stated to me that the pleasantest way to get rid of them was to have plenty of cats, so I thought I would coax the cats around me, as they were plentiful. We decided that the best way to get the cats was to coax them by feeding them, and so we put out a pan of milk every night. The result was that we had a large number of cats. Between that and the irrigation, we have very few gophers, if any. I have not seen any for months on the ranch.



## TREATING THE SURFACE OF THE ORCHARD.

MRS. JONES then read the next question, as follows: "Is it best to roll or otherwise press fine the surface of an orchard?"

MR. SPRAGUE: Mr. President, in the absence of further remarks, I should say it is better to leave the ground in such condition as not to require the application of rolling. If the ground is harrowed so that no lumps are found, then it is better to try to pulverize no further.

MR. MOSHER: Mr. President, I think it is a very bad principle to roll land and leave it in that condition, as it leaves the surface very smooth and causes a very strong reflection from the sun.

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TRIMMING YOUNG TREES.

MRS. JONES then read the next question, as follows: "Are young trees or vines likely to be injured by being trimmed in the fall, before fully dormant? If so, why?"

MR. BERRY: Mr. President, this question seems to open up the whole question of pruning. Some years ago there was a peach orchard started in Bakersfield, and the phenomenal production and wonderful size of the fruit from that orchard were so striking that I, with one of the best known fruit growers in the State of California, purchased a part of that orchard. He and I, in talking over the matter, decided that we were pruning too much. Since that time he has adopted the plan a good deal, and I have adopted the plan of leaving them alone altogether. Last summer, when the peaches on my orchard were growing, I pruned those particular peach trees. I know that I was criticised by some of my neighbors, and some of them said that Captain Berry was crazy. I had the largest peaches, I think, ever grown in the State. I have not pruned those trees any more, and do not intend to. We are pruning our prune trees in Tulare County—those that have been planted one year. After that we do not prune them any more. With regard to apricot trees, I prune them in June. With my Bartlett pear trees, I do the same thing in June. I have obtained excellent results.

MR. LELONG: Is the pruning you do in June the cutting back of the old wood, or the new growth?

MR. BERRY: The new growth.

MR. LELONG: Then you do not cut the old growth?

MR. BERRY: Not any more that year.

MR. LELONG: You leave the old growth alone and only attend to the new.

MR. BERRY: Yes.

MR. KELLS: Mr. Chairman, I think we ought to have another field for the experiment station to work on.

MR. BERRY: Mr. Kells, my trees were making such an enormous growth and showing such an immense foliage up in the air, that I could not see where the benefit was for the tree to waste its energy on a limb that would eventually be six or seven feet long. I have cut that off in order not to waste its energy on the wood. I conceived that it would be better to cut that wood off and let it expend its energies on good fruit. So I cut the tops off four or five feet and let the sap go into the fruit. I attribute such fine fruit as I produce to my action.

MR. THOMAS: I saw the orchard, and it was the most remarkable crop of peaches I ever saw in my life. They would certainly have broken at the base. I will state right here, that as long as I have been in the fruit-growing business, that forty acres bears the largest crop I ever saw.

MR. BERRY: The fruit on the trees kept on growing. Their buds developed excellently. I never saw an orchard in better shape than it is to-day in regard to the development of fruit buds. They started on top, but did not grow on top any more, only about six or seven inches. The growth kept on spreading in this direction.

MR. LELONG: I will ask, in June pruning of the peach especially, have you observed wood that comes out after that and produces fruit buds? Isn't it a fact that the bud is produced on the new wood, and that that bud generally comes on the first shoot; that is, on the shoot made in the spring; and that by summer pruning or the June pruning, you get a willowy growth without fruit buds? Now, if these experiments are as I have stated, how are we to obtain fruit buds on this June growth for the next crop?

MR. BERRY: I could not answer that question.

MRS. JONES: I was about to ask how old these trees were, and if they continue to bear this phenomenal crop every year?

MR. BERRY: They are two years old.

MRS. JONES: Then you are simply experimenting?

MR. BERRY: I say I conceived that was the best plan to pursue with peach trees, arising from my observation in the orchard at Bakersfield. In consultation with a gentleman there, we decided among ourselves that all the orchardists of California, as far as we knew, were cutting their peach and prune trees too much. After that he purchased about one hundred acres of land in the vicinity of Hatch's place, and gave it to one of his sons. They have never pruned that orchard but once, and they make that statement.

MR. LELONG: I am well acquainted with the Treat orchard, at Biggs, having gone there every year since the first tree was planted in that section. I was looking into the question of lands before there was a tree planted there at all. This Treat orchard has been raised without any pruning, and alongside of it is the Hatch & Rock, the Hammon & Alexander, and Reed & Johnson orchards, and they prune. It seems that every one differs as to the method of pruning. The result has been that the Hatch & Rock orchard, for instance, is pruned very heavily. They have grown enormously large peaches, as large as Mr. Berry has said he sent to the State Board of Horticulture, and their trees are kept within the bounds of growth. The Reed & Johnson place is trimmed a little differently, and this year their fruit was so heavy on the trees that a great many of the trees broke, and fruit could not be shipped because there was a glut of fruit in the market, and nothing but good fruit could be shipped. Then, again, the Treat orchard, that is having no pruning at all, shows a marked difference. The growth is so luxuriant, that it takes the vitality away from the fruit, and the fruit will shrivel and dry on the tree. Go there now—it is a sight—you will find on each tree as many as a thousand peaches on the old wood, dried. They never developed. I think the experiment has illustrated the fact that these trees will have to be pruned or will have to be propped up.

## RESOLUTION OF THANKS.

JUDGE TILDEN: I have a word to say, if it is in order. To-day, as we all know, the citizens of Los Angeles gave us a rare treat. We were invited to take a ride through the most beautiful country that I have visited for many a year. We were treated well. We had a pleasant ride and a safe return home, and, as we are about to part, I think it is proper to adopt a resolution, that this convention tender its thanks to our Chairman and the citizens of Los Angeles for the courtesies they have extended to us during the convention, and especially for this ride.

MR. BRAINARD, of the Committee on Resolutions, presented the following resolutions, which were unanimously adopted:

*Resolved*, That the thanks of this convention are especially due to the citizens of Los Angeles, through their Reception Committee, of which the Hon. G. J. Griffith is Chairman, for the most complete and well-arranged plans for the reception of the visiting fruit growers, and for the crowning effort for their pleasure in the way of a carriage excursion through the city of Los Angeles, Pasadena, and portions of the San Gabriel Valley, giving a view of the costly public buildings and beautiful residences, as well as the luxuriant groves of citrus trees, just now giving promise of an abundant harvest.

*Resolved*, That the thanks of the convention be tendered to the daily papers of Los Angeles, which have so faithfully and accurately reported the interesting proceedings of the sessions; to the California Club, for courtesies extended; to the Southern Pacific Company for a free excursion to Port Los Angeles, and the offer of greatly reduced rates for a trip to Indio; also to the Santa Fe Company for the tender of an excursion around the kite-shaped track, and also to the Mt. Lowe Mountain Railroad Company for the tender of an excursion over this remarkable road.

That to the Hon. Ellwood Cooper, who, in spite of feeble health, so ably performed the duties of President, we extend thanks; and to the two Vice-Presidents, Hon. Abbot Kinney and G. J. Griffith, thanks be also tendered for the able and courteous manner in which they discharged their duties as chairmen of the convention during the absence of President Cooper. Also, that the thanks of the convention are due to the Secretary, B. M. Lelong, and to the Assistant Secretaries, Rev. A. T. Perkins, of Alameda, and Mrs. Hattie S. Jones, of Sacramento, for their important services rendered.

MR. GRIFFITH (Chairman): The Chair thanks the convention very deeply for the compliment, I can assure you. However, I do not think the resolutions cover it all. I think that we have all been very much pleased, delighted, highly entertained, and have learned a great deal from papers that have been read. I think some of the gentlemen who have devoted so much time to the preparation of the papers that have been read here, deserve certainly the thanks of this convention. And, in view of the fact, I suggest that some gentleman move that a vote of thanks be tendered to those who have so ably presented their papers before this convention. I think some of them have been the ablest I have ever heard, and for that reason it is eminently due those gentlemen that we should not ignore them by any means.

MR. SPRAGUE: I move you that the thanks of the convention are due, and are hereby tendered, to those who have presented papers for the information and consideration of the convention.

This motion was seconded and unanimously adopted.

MR. BERWICK: If Berwick, of Monterey, has not tired you out already, gentlemen, I will thank you for the kind consideration of the papers we have given you, and I think you may hear again of the nationalization of railroads. [Laughter.]

THE CHAIRMAN: The Chair would suggest that if there be nothing further, and as the hour is getting late, that it would be in order for the meeting to adjourn.

MR. LELONG: Before any such motion is put, I would like to say that I have attended a great many conventions in this State. In fact, ever



since 1884 I have had part of the management of all of them, and I have never met a more intelligent body of people, in convention assembled, than I have at this session. There has been more intelligent discussion and the best papers that I ever heard in my life have been read at this meeting. This is the index of our future work. I think when we meet at Sacramento, the people who read the proceedings of this meeting will come there and will make a similar effort, and I hope as many as can do so will attend that convention, because it will prove very profitable to them all.

MR. KELLS: Mr. Chairman, one more thing. I would like to call the attention of the convention, before we part, to one of the most important and most interesting subjects before the convention, and that is "coöperation." Let us not go home, after we have been so enthused over the matter of coöperation, and allow the matter to die on our hands, and wait until we meet again in 1894 and have to reconsider the work of coöperation. [Applause.]

On motion of Judge Tilden, duly seconded and carried, the meeting adjourned *sine die*.



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# REPORTS

FROM

County Boards of Horticultural Commissioners.

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# REPORTS FROM COUNTY BOARDS OF HORTICULTURAL COMMISSIONERS.

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Section 4 of Chapter CCLXV of the laws of 1889 provides: "It shall be the duty of said County Boards of Horticultural Commissioners to keep a record of their official doings, and to make a report to the State Board of Horticulture, on or before the first day of October of each year, of the condition of the fruit interests in their several districts, what is being done to eradicate insect pests, also as to disinfecting, and as to quarantine against insect pests and diseases, and as to carrying out of all laws relative to the greatest good of the fruit interest. Said Board shall publish said reports in bulletin form, or may incorporate so much of the same in their annual report as may be of general interest."

In 1892 only six reports were received, and these nearly at the end of the year, so that they could not be embodied in the annual report. In 1893 there was but one report filed on time (by G. W. Harney, of Marysville); the rest were filed much later.

Many of these County Boards lack system in making out their reports. Some have never had a meeting, and their report for the year is sent in the form of an individual letter, without the approval of the other Commissioners. Hereafter it would be well for all County Boards to call meetings to consider and approve their annual reports to be submitted to the State Board for publication.

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## ALAMEDA COUNTY.

*To the State Board of Horticulture, San Francisco, Cal.:*

GENTLEMEN: In conformity with the provisions of Section 4 of an Act entitled "An Act to protect and promote the horticultural interests of the State," approved March 19, 1889, relating to County Boards, I herewith respectfully submit my report as a member of the Board of Horticultural Commissioners of Alameda County.

During the past year I have visited all the orchards that were reported to me as being infested with insects injurious to fruit trees. I also visited places where I had reason to believe such insects existed. In all cases where I found insects pernicious to horticultural interests I ordered the trees disinfected.

There are several nursery establishments in my district which import trees and plants, and I paid a good deal of attention to these places. The result has been that the proprietors have learned to second my efforts, and have frequently asked me to call at their places during the year, especially during last spring and summer, when they were receiving and shipping many orders. I have not only visited these places when requested by these nursery establishments, but at various other times, when the proprietors did not expect my coming.

The colonies of insects introduced into the orchards of the State University by the officers of the State Board, to prey upon the injurious insects that from time to time get a foothold in said orchard, are beginning to do good work. I am watching them with some interest, and hope to soon see them spread to other orchards in this part of Alameda County.

The fruit interests of the county, as far as I can learn, have been very good this year. They have not been injured to any perceptible extent by the codlin moth.

Respectfully submitted.

TEMESCAL, October 31, 1893.

A. D. PRYAL,  
President.

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### BUTTE COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: The deciduous orchards of Butte County throughout the valley below Oroville, on both sides of the Feather River, that were infested with the scale *Aspidiotus perniciosus*, have been sprayed with the lime, sulphur, and salt remedy. Those that were sprayed in 1892 were not sprayed this last winter. The work was done in orchards that never had anything done in them before. I have not been in the mountains in my district to do any work, only to look around, and found only the soft brown scale on the oranges and the pernicious scale on the deciduous fruit trees. I hope soon to go among the owners of orchards and have them do something toward cleaning their trees.

The soft brown scale I find in all parts of the county that I have been in, and some trees in Oroville, Thermalito, Palermo, and vicinity, are very badly infested.

The yellow scale, in Oroville, has been sprayed with the rosin wash. First, the court-house grounds last spring, and this fall, in September, all the infested trees in the town were sprayed.

Have found the black scale on olive cuttings only three years old, and a number of blocks away from old olive trees that were infested, and find them in limited numbers in other yards about Oroville.

I will let Mr. Gray's report cover a part of mine, as our experiences have been similar in many ways, and will not take up your time in repetitions.

Nursery stock that has been raised in the county is as a rule very clean. Great pains have been taken to avoid shipping any trees with root knot. In some nurseries all the stock shipped was treated with hydrocyanic acid gas. There were received into the county from outside the State: One carload of assorted deciduous fruit trees, containing about 23,000 trees, from Oregon, and these were free from insect pests.

From Missouri, two carloads, with about 40,000 trees. The peach trees were infested with the Eastern peach borer (*Ageria exitiosa*). These were quarantined and finally destroyed by burning.

One carload of about 9,000 orange trees, from Florida, infested with purple scale, were quarantined and gased and held until the eggs of the scale were all destroyed.

Four carloads of 4,000 orange trees, from Southern California, were received, infested with black scale. The trees were dipped in a solution



of whale-oil soap, as many of the trees had live scale upon them. These trees have been watched closely all summer, but I have not been able to find any live young black scale upon them.

One shipment of 200 orange trees, infested with purple scale, that had been received in another county and reshipped here, but which had not been disinfected, was quarantined and gased and held until clean.

A number of shipments of deciduous fruit trees were received, with certificates to the effect that the trees were free from root knot. Upon examination, however, I found a good many were infested with root knot.

Yours respectfully,

EBEN BOALT,  
Horticultural Commissioner.

November 7, 1893.

*To the honorable State Board of Horticulture:*

GENTLEMEN: The pernicious scale is certainly on the decline, for many orchards in this section where no spraying has been done have less scale than formerly, and a large per cent seem to be dead, and if I am not mistaken they have been punctured by some enemy, but what I do not know. A few ladybirds have been found, but not in numbers sufficient to accomplish what has been done.

The codlin moth has not been active this year; as near as I can tell, not more than one fourth as bad as in former years. Some of the orchardists sprayed with Paris green, others did not. The red spider and yellow mite started in quite early on almond and French prune trees, but the cool summer and damp nights were not favorable to them, and the damage they did was light. On Rancho Chico two spraying outfits were operated nightly for two weeks, and killed a great many, but about the time operations ceased the scale began to disappear anyway.

According to your request at the last Horticultural Convention, I sent samples of pear blight to Washington, and in due time received a reply saying it was the genuine Eastern "pear blight"; but, unlike the blight in the East, it is not spreading. In orchards that had some of it two years ago, and where the affected parts of trees were cut out and burned, it has not appeared again. Some young trees that were black clear around the body have a new bark formed under the black bark; the latter flaked off, and the trees hung full of fruit this year.

We have a few grapevines of the Rose of Peru and Mission varieties which, without any apparent cause, when they had put out about eighteen inches of growth, and the first grapes were about the size of buck-shot, suddenly died. I dug down four feet, but could not find any trouble with the root. Some of these vines were twenty years old. Prof. Newton B. Pierce examined them last winter and did not think it was the same disease which they have had in the southern part of the State, and he could not find the cause.

The *Agaricus*, or root fungus, is doing a good deal of damage in some orchards, and I find very few know what is taking their trees in spots. I sent samples to Professor Pierce, and he came up here and spent a week examining the roots, and took samples of the fungus home with him to propagate, in order to find to what family it belonged. I am in hopes he will be able to report at our meeting at Los Angeles, and that a remedy may be found, for if it spreads, as it seems inclined to do, and no way of stopping it can be found, many tracts of good fruit land will

in time become unfit for tree raising. One of our orchardists, who is now preparing to set out a large orchard, is having his men follow up the oak roots to the end, if it be thirty feet, in order to prevent the fungus getting his fruit trees. Thus far I have not found pear trees affected, but peach, apricot, prune, and plum are liable to attack.

All of our nurseries are looking fine, and the proprietors are doing all they can to prevent the spread of insects, diseased trees, root knot, etc. They are all equipped for gasing their trees this winter. I have not found any scale on the orange trees of this part of the county.

Commissioner Boalt, of Palermo, will report for Oroville, Palermo, Gridley, and Biggs.

Yours truly,

G. M. GRAY.

CHICO, October 30, 1893.

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### HUMBOLDT COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: I have the honor to submit herewith the annual report of the Board of Horticultural Commissioners of Humboldt County.

The orchards of this county have, during the past year, been inspected by local inspectors and members of the Board, and the general consensus of opinion is that trees are in a much better general condition than at this time last year.

The woolly aphid and oyster-bark scale (*Mytilaspis pomorum*) continue to be our most annoying pests, but judicious treatment is keeping them in bounds. The pernicious scale had made its appearance in various parts of the county and threatened to become a serious pest, but wherever the "lime, sulphur, and salt" spray has been faithfully applied it has been completely eradicated. Spraying with this preparation is quite general, though many prefer a solution of concentrated lye.

The present year has seen a remarkable increase in the acreage of new orchards, especially of apples and prunes. This county has much land admirably adapted to the growth of both of these fruits. The county is now producing and marketing a remarkably fine quality and rapidly increasing quantity of dried prunes and apples. A cannery has been for the past two seasons in successful operation in the Eel River Valley, and its presence has caused a large increase in the acreage devoted to peaches and small fruits.

The yield of apples, although light, is larger than last year, and the quality is unexcelled. We have no codlin moth, and we are doing our best to prevent its introduction.

On the whole, the fruit prospects of Humboldt County have brightened very materially during the past year, and it cannot be long until Humboldt County will be numbered among the more important of the fruit-producing counties.

All of which is respectfully submitted.

J. B. BARBER, President,  
CARL C. MARSHALL, Secretary,  
J. L. NOE,

Commissioners.

EUREKA, November 18, 1893.

## KERN COUNTY.

*To the California State Board of Horticulture:*

GENTLEMEN: We, the County Board of Kern County, respectfully submit to your honorable Board our report of the condition of orchards, etc., visited and examined by us.

We find that the San José scale is the only pest that has caused any damage to the fruit interests of our county. Of two hundred orchards examined we find ninety-three that are clean, and one hundred and seven that were infected with scale. Some are badly diseased, but on an average not nearly as bad as last year. Nursery stock has been in prime condition, and all young orchards are clean. We have caused all infected places to be sprayed with lime, sulphur, and salt, and find that when applied thoroughly this remedy has proved very effective, and we think that the scale is under control in this county; but it is impossible for the Board to make a clean sweep of the pests without the coöperation of all persons having infected places, as they can comply with the law and still breed scale, for, by not doing the spraying thoroughly, they do not kill all the scale and their eggs; and when the orchards are distributed over so much territory as is the case in Kern, the Commissioners cannot eradicate the pests except with the help of parties interested and the continual vigilance of the State Board.

Respectfully submitted.

C. F. BENNETT,  
Secretary.

BAKERSFIELD, September 29, 1893.

## LAKE COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: Samuel Graham, of Lower Lake, W. G. Young, of Kelseyville, and E. P. Wray, of Lakeport, constitute the County Board of Horticultural Commissioners of Lake County.

The Board met at Kelseyville, May 6, 1893, and organized by electing W. G. Young as President, and E. P. Wray, Secretary. E. P. Wray drew the three-year term, W. G. Young the two-year term, and S. Graham the one-year term. The county was divided into three sections, Mr. Graham taking charge of District No. 1, comprising Lower Lake and Middletown sections; Mr. Young, District No. 2, comprising the Kelseyville and Big Valley sections, and E. P. Wray taking District No. 3, comprising that portion of the county from Lakeport north, and the east side of the lake as far south as Paradise Valley.

As the season was so far advanced but little could be done in the way of fighting pests, and the work of the Commission has been directed to inspecting orchards and doing as much as possible toward educating fruit growers respecting pests. The orchards of Lake County have been remarkably free from insects in the past, and most growers are entirely ignorant regarding them. In the last few years several varieties have made their appearance and the war is upon us.

Mr. Graham reports finding numerous orchards in his section infested with woolly aphis, oyster-shell scale, and pernicious scale. Mr. Young reports the pernicious scale in his section and also the pear slug. Mr.



Wray reports the pernicious scale as infesting numerous orchards in Scott Valley and in Lakeport and vicinity. It is also found near Upper Lake. A species of green aphid infests several orchards in Scott Valley, and the red spider has been observed in several places, but seems to do no damage and has disappeared from some orchards. A species of canker worm made its appearance in great numbers in one pear orchard, but one spraying with Paris green was sufficient to exterminate the worm. The codlin moth infests the whole county. Several orchards in Scott Valley were sprayed with the lime, sulphur, and salt wash, early in the spring, and where done thoroughly has been effective in destroying the pernicious scale. Spraying with Paris green was effective in destroying the pear slug near Kelseyville.

So far the people seem willing to coöperate with the Board in the work of destroying pests, and but little opposition is experienced. It is expected that all infested orchards will be thoroughly sprayed at the proper season.

Planting of fruit trees still goes on, and many young orchards will come into bearing next year. The most successful fruits are the apple, pear, and prune. Peaches, apricots, figs, and oranges do well only in particular places.

Some orchards have lost many trees from sour sap, and a remedy for this disease is wanted. Many trees die down to the ground while the root remains in good condition and sends up a multitude of thrifty sprouts. So far it seems to be worse on warm soils than on heavy and wet land.

Respectfully submitted.

E. P. WRAY,  
Secretary.

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#### LOS ANGELES COUNTY.

*To the honorable the State Board of Horticulture:*

GENTLEMEN: The past year has not been encouraging to the fruit growers of this county. In many localities, especially along the foothills, much damage was done to the citrus crop by the heavy winds in December. Prices ruled low all through the season, and few if any of the growers had satisfactory returns. Deciduous fruits, with the exception of apricots, were a good crop, but prices have not been very satisfactory. The prospect for the coming orange crop is fair. Seedlings will be light, but budded varieties good and of fine quality.

During the last planting season I had to destroy many thousand trees affected with root knot, also a large number infested with borers. Importation of citrus stock from Florida has almost ceased.

Yellow scale has almost entirely disappeared in this county, except in the Downey and Rivera districts. Red scale in the neighborhood of Los Angeles City is dying out, apparently from the attack of a fungus. Black scale is still very troublesome; in fact, it has been worse this year than ever before.

There are a few orchards in Downey and Rivera in which some trees are infested with purple scale. These trees I am having cut back and fumigated, and hope to eradicate the pest in a very short time.

Pernicious scale is still with us, but has been almost entirely killed

out in most of the county. Frosted scale has increased during the past season. We are now spraying the infested trees, and hope to keep it in check.

During the past season upward of 40,000 citrus trees have been fumigated for the red and the black scale. There are at present about two hundred and fifty tents at work, also a large number of spraying outfits. I am in hopes that the *Rhizobius ventralis*, colonies of which have been sent to many orchardists by the Hon. Ellwood Cooper, will prove effective on the black scale. The *Orcus chalybeus* has increased in numbers to some extent, but not sufficiently to justify the removal of many for colonies.

Respectfully submitted.

JNO. SCOTT,  
Horticultural Commissioner.

LOS ANGELES, September 30, 1893.

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### MENDOCINO COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: We, the County Horticultural Commissioners of Mendocino County, beg leave to submit the following report:

We have divided the county into three districts, as follows: District No. 1 comprises all that section and territory known and described as follows: Beginning at the county line on the road from Cloverdale to Booneville, it includes all north and east of said road to the divide and west to the Pacific Ocean.

District No. 2 comprises all the southern and middle portions of Mendocino County not included in District No. 1, extending as far north as the headwaters of Russian River in the valleys, and to Mendocino City, and the coast.

District No. 3 includes all that portion of Mendocino County not included in Districts Nos. 1 and 2.

Mr. Leslie Hoag, of Booneville, has been assigned to District No. 1; Mr. L. U. Babcock has been assigned to District No. 2; Mr. Thomas B. Henley has been assigned to District No. 3.

In performing our duty of inspecting nursery stock brought into the county, we have placed in quarantine two lots of apple trees from Sonoma County that were infested with woolly aphid, and one lot of peach and apricot trees from Nebraska that were infested with the Eastern peach-root borer. These trees last named were destroyed by the Horticultural Commission.

In inspecting orchards we find the following named pests in various parts of the county, in numbers sufficient to be alarming: Pernicious scale, oyster-shell scale, greedy scale, woolly aphid, and codlin moth.

In endeavoring to eradicate the pernicious scale, and perhaps the most serious pest, it has been necessary to destroy about four thousand trees, mostly in District No. 2.

Nearly all of the badly infested orchards have been sprayed with the lime, sulphur, and salt wash, for the purpose of disinfecting them, and much of the work has been done in a thorough and workmanlike manner.

Horticulturists throughout the county are taking a lively interest in

destroying pests, and are seeing the necessity of doing so. With thorough and united action we believe these pests can be eradicated, or at least their ravages can be so checked that there need be no apprehension, but in this case "eternal vigilance" is the price of fruit.

We also find that the fruit industry is rapidly becoming an important one in this county. As near as we are able to estimate, the value of the fruit output of this county is at least \$15,000, and as yet very few of the young orchards have come into bearing.

We are able to report to you that the people are becoming convinced that the returns from land set to fruit are better than from any other use to which said lands can be put. In evidence we would submit the fact that there have been at least 50,000 trees set out in orchard during the past season, and we know that these trees are practically free from insect pests.

Respectfully submitted, by order of the Horticultural Commission.

UKIAH, October 1, 1893.

L. U. BABCOCK,  
Secretary.

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#### MONTEREY COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: In accordance with law, I have the honor to submit the annual report of the Horticultural Commissioners of Monterey County, for the year 1893.

A great deal of interest in the way of planting orchards has been shown in the last four or five years, and this is destined to become one of the leading fruit-growing counties of the State.

The prominent feature of our county is its similarity, topographically, to the State. The great Salinas Valley extending from northwest to southeast through the center of its entire length, and the two mountain ranges on either side: the Santa Lucia range along the coast, with its numerous valleys and fertile hills, all abundantly watered and particularly adapted to the different fruits and berries, according to the difference of climate and soil; the Gabilan range, on the opposite side, equally rich and fertile in its greater portion, where every variety of fruit known in the State can be and is now being grown, in a limited degree.

We have in our county all degrees of temperature, from the cool winds and fogs of Pajaro and Salinas, by steps, as it were, to greater heat until we reach San Lucas and San Ardo—the Jolon Valley on the west, and Cholame Valley on the east, as we go south, with all the heat of the San Joaquin Valley.

Around Salinas and in the Carmel and Pajaro Valleys, the pear and apple arrive at a high state of perfection, and are almost entirely free from codlin moth, so destructive in other parts of the State. All the berries thrive in those localities, also, and much attention is being given to their cultivation. In these we find the oldest orchards, some planted many years ago, consisting of all the varieties of fruit grown in the State, showing what is peculiarly adapted to that locality. Many persons have started young orchards, improving on that experience.

The next in importance as a fruit country is the country lying between



Salinas and Pajaro, east of the latter, known as the San Miguel Cañon district, including Carneros. Here are orchards containing as high as fifty and sixty acres, from one to five years old, in a high state of cultivation and intelligently planted as regards adaptability to soil and climate. Prunes and apricots are extensively grown and reach a high degree of perfection. Peaches also do well. Other fruits average well, and are comparatively clear of all pests.

To the west, in the Carmel district, are some young orchards, which we failed to see, on account of the limited time allowed.

The next in importance is the Gonzales district, about eighteen miles south of Salinas, where we find some very fine orchards that are intelligently planted and cultivated. When we leave the river bottom, where there are fine apples, we find the prune, pear, peach, almond, and olive taking the lead, but all fruits are grown and are of fine quality, including the grape. At one small olive orchard of the Mission variety, some olive oil is manufactured.

In the Soledad and King City district, back in the valleys and hills, little attention is paid to fruit raising, but there are a few small orchards. The almond seems to be perfect, bearing heavily, while young, a fine, plump nut. The prune does well, and also all pitted fruits, judging from small orchards for family use which were visited.

In going from King City to San Lucas we find larger orchards and more attention being given to fruit, land being owned in small holdings, and all fruits promising well, especially almonds, prunes, and grapes. In the Jolon Valley and along its tributaries is a fine country, and prospects for the fruit industry are very flattering. Then as we cross the Salinas Valley to Cholame Valley, in its upper part we find some young orchards in which the stone fruits excel. The grape is destined to reach considerable importance in that portion of our county. A great deal of intelligence has been displayed in adapting the different kinds of fruit to the localities, the growers having based their judgment on the old orchards that were planted many years ago.

Considering the fact of there being no Commissioner or Inspector in the county until this year, and infested trees having been shipped all over the county at the will of nurserymen, we find the orchards wonderfully free from pests, yet their ravages are to be seen in all localities. Not having been appointed until late in the season, and the time allowed by the Supervisors being very limited, it has been impossible to do all that should have been done toward the destruction of pests.

In the old orchards in Pajaro and below Salinas we found the bark-louse or oyster-shell scale, rose, and willow scale. In the neglected orchards they were very bad, as was also the woolly aphis. In some the pernicious scale was found, but not in any great numbers; also in Pajaro and Carneros country black scale, which infests many forest trees.

I forced the spraying with lime, sulphur, and salt, with good results. Nearly all the young orchards are comparatively clean, systematically planted, and cultivated in the most improved manner.

In the southern part of the county there is considerable trouble from borers, particularly where the trees were not well cut back.

Owing to the great heat of the sun and no means of irrigation, orchardists have to depend upon nature's moisture, properly aided by cultivation, to make trees live through the first year, after which they grow luxuriantly and bear abundantly.

As we approach nearer to Salinas the trouble grows less, and by the time we reach this vicinity we never hear of a borer, the summers being so cool and the air carrying so much moisture. The thermometer rarely indicates over 85° in the shade, while in the southern part of the county it often registers 110° and 115°.

Around Salinas we see but little signs of codlin moth, and in some orchards not a trace. Our greatest pest is woolly aphis.

There are about three thousand acres in fruit trees in the county, two thirds of which have been planted during the last five years. One fourth to one third of these trees are prunes. Of walnuts, the few trees in bearing promise well, being heavily loaded in this vicinity.

Respectfully submitted.

D. G. MACLEAN.

SALINAS CITY, November 4, 1893.

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### NEVADA COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: In complying with the law in regard to the horticultural interests of Nevada County, I will state that there is a decided improvement in the condition of the orchards of this county. Having been all over the county, in the infected districts I find that the scale is not nearly as plentiful as it was last year. The people as a general thing comply with the law and do the best they can, and if interest increases in the next two years as it has in the last two years, the scale will be a thing of the past. Our principal pest is the pernicious scale. With the remedies at hand there is no trouble to get rid of all the fruit pests with a little work. There are some few persons who do not like to work, but I think they will fall in line soon. This is about all I can report in regard to insect pests.

Regarding imported trees, so far as I have seen they are all free from pests. The most of our young orchard trees are raised in this county. I find in my travels that orchardists are putting out a great many nut trees.

This report applies to all three districts. Hoping this will be satisfactory, I remain

Yours truly,

JAMES R. VINEYARD,  
Secretary.

ANTHONY HOUSE, November 2, 1893.

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*To the honorable State Board of Horticulture:*

GENTLEMEN: A report at this date is not so bright as I should like it to be; but scale is not as bad this season as it has been for some five or six years previous. There is something strange about it. Last summer the scale was bad all through the town of Grass Valley, and in some places on the outside. Many of the orchards were not sprayed, and this summer these trees are in better condition than many of those that were sprayed. I think, from the indications of this summer, that the scale will go. But it has killed hundreds of trees in this vicinity.

However, the trees generally are looking far better this summer than for years before.

There has not been much planting of trees in this section the past two years, and I doubt if many will be planted this season.

Fruits of all kinds are better and cleaner this season than they have been since the pest invaded this county.

Respectfully yours,

STEPHEN L. RICHARDS,  
Commissioner.

GRASS VALLEY, November 2, 1893.

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*To the honorable State Board of Horticulture:*

GENTLEMEN: I would respectfully report that I am trying my best to eradicate the scale, a labor which I find to be uphill work. Scale is not diminishing much in my immediate district. Most of the orchards here are small, comprising from six to twelve acres, and it is impossible to get all the owners to spray.

Most of the spraying done this season was with a patented preparation. There were thousands of pounds of it used in my district, and I pronounce it of no value.

Yours truly,

HENRY WATTERS,  
Horticultural Commissioner.

NEVADA CITY, November 6, 1893.

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### ORANGE COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: Orange County is one of the youngest and smallest counties in the State, having been organized but three years, and containing but seven hundred and fifty square miles.

Orange growing is the chief horticultural industry. Eight hundred carloads is the estimated output of the present season. This is equal to the entire crop of Southern California seven years ago. Although citrus fruits form the chief product of the county, every variety of fruit found in California is raised here with success. Walnuts are also a grand success. The raisin grape flourishes again as formerly. The growers of this county are now organizing five or six unions on a uniform plan to constitute one exchange, which will coöperate with like organizations throughout Southern California for mutual protection and benefit in marketing the crop.

For horticultural purposes this county is divided into three districts. One Commissioner is assigned to each district, and serves as his own inspector. The three form a Board for business, and, under the law of 1891, meet once a month at the county seat for business and consultation. It is the aim of this Board to execute the law as efficiently as possible, with the minimum cost to the county and without friction among the fruit growers. The time given by each Commissioner averages about five days per month, at \$3 per day, or \$15 per month. The entire cost to the county for the Board is less than \$600 per year.



It is customary for the members of this Board to visit each other occasionally between monthly meetings, for inspecting each others' methods and surroundings. Nine tenths of the fruit growers of this county need no pushing, but the other tenth (principally non-residents) require our attention. We find the law of 1891, as published in Bulletin No. 59 of the State Board, and the assistance of our County Attorney, all that we need to make our work easy and our duties pleasant.

Our enemies are legion, being almost every variety of *Aspidiotus*, *Lecanium*, and aphid; but our chief enemy is the red scale (*Aspidiotus aurantii*). Fifty thousand dollars a year would hardly cover the cost of the fight against this scale. We keep from forty to fifty tents in constant use, that cost on an average \$85 each, and to run them costs from \$3 to \$5 each per night, in labor and chemicals. Besides these, we keep in almost constant use eight or ten spraying outfits that cost from \$8 to \$12 per day.

We make all the use possible of parasites. For the cottony cushion scale the *Vedalia cardinalis* is all that could be desired. For the black scale we have lately received a few colonies of the *Rhizobius ventralis*, but cannot yet speak of their efficiency.

We find that each new pest added to our stock comes to stay; that no means of destruction at our command are adequate to its entire removal; that in spite of our best efforts at quarantine, new ones are being added to our list, and that our hope of success in this warfare must be in the introduction of beneficial insects and parasites. It is our opinion that our State authorities ought to keep one scientific and practical man constantly in the field in search of these friends to the fruit growers, and that the government at Washington ought to keep many such.

HIRAM HAMILTON,  
B. J. PERRY,  
I. N. RAFFERTY, Secretary,  
Commissioners.

SANTA ANA, October, 1893.

#### PLACER COUNTY.

To the honorable State Board of Horticulture:

GENTLEMEN: The County Board of Horticultural Commissioners of Placer County beg leave to report as follows, for the season just past:

The Commissioners have been active and are pleased to state that the people have complied with the law very generally. We have had no trouble to get them to spray their fruit trees, and can say that beneficial results have followed. The scale pests are disappearing and very little codlin moth is to be found.

We destroyed one lot of prune trees, which we found infested with borers.

It was an oversight in not making a report on October 1st. We are all fruit raisers and were very busy in October.

Respectfully yours,

W. M. BAKER,  
H. E. PARKER,  
GEO. W. APPLGATE, Secretary,  
Commissioners.

AUBURN, November 10, 1893.

## RIVERSIDE COUNTY.

To the honorable State Board of Horticulture:

GENTLEMEN: The first report of the Board of Horticultural Commissioners of the new county of Riverside is respectfully submitted.

Riverside County was created by law in May, 1893, from the southern part of San Bernardino County and the northern part of San Diego County. The appointment of a Board of Horticultural Commissioners was one of the first acts of the Supervisors, as the fruit interests of this county were manifestly paramount. The personnel of the Board is as follows: Chairman, Judson House, of Riverside; Secretary, Charles W. Godfrey, of Moreno; Treasurer, George W. Van Kirk, of South Riverside. Each member of the Board assumed charge of a district, the county being divided into three parts.

The Supervisors passed a county ordinance more comprehensive than any existing State or county law touching horticultural interests. Twenty-two local inspectors were appointed, and a complete inspection of orchards was begun. The magnitude of the work has prevented its completion in time to make an itemized report at this writing.

The older orange trees are infested to a slight extent with the red scale (*Aspidiotus aurantii*) and cottony cushion scale (*Icerya purchasi*), and fumigating with hydrocyanic acid gas has been continually resorted to, with complete success. Soft brown scale (*Lecanium hesperidum*) and black scale (*Lecanium oleæ*) are less dangerous pests; they are treated with the usual washes.

A few of the older orchards of deciduous trees contain pernicious scale (*Aspidiotus perniciosus*), and the lime, salt, and sulphur wash is used. Isolated cases of red spider, pear slug, and woolly aphis have been found and fought with the usual remedies. As all the foregoing pests need but timely attention, their control is always possible.

The root knot affecting deciduous trees is attracting much attention, as its evils seem widespread and incurable. A frequent cause is extreme summer pruning, or loss of leaves by insects or blight, destroying the ability of the tree to assimilate the full amount of sap furnished by the roots. Another common cause is the result of budding slow growing plum and prune stock onto rapid growing peach root. The union is very imperfect, and a collar and crown knots are produced. This disease is at present incurable, although not contagious, and in exceptional cases affected trees have borne crops, yet by no means should young trees with root knot be planted. Bearing orchards may be so pruned while growing vigorously, or their cultivation so neglected, as to produce this trouble.

The orange industry of Riverside and vicinity is too well known to need elaboration now. The shipments for the season of 1892-3 were 2,525 carloads.

South Riverside has about 3,000 acres in citrus fruits, mostly oranges, though many lemons were planted this year. The water supply has recently been supplemented by the purchase of Lake Elsinore.

Moreno and Alessandro have 22,000 acres under the water of the Bear Valley system, and have planted 4,000 acres of young orchards, evenly divided between oranges and deciduous fruits.

San Jacinto has many fine pear and plum orchards in full bearing, with a total of about 3,000 acres. The Hemet tract is a well-watered body of

fine land now being put on the market. It will all be set to orchards eventually.

Banning contains 3,000 acres of orchards and vines, and raises fine deciduous fruits. Abundant water is obtained from the surrounding mountains.

Perris receives water from the Bear Valley system, and has 2,000 acres of citrus and deciduous fruits.

The Lakeview tract has recently been opened between San Jacinto and Perris. Artesian water has been developed from the subterranean bed of the San Jacinto River, sufficient to irrigate 3,000 acres, which will be planted to orchard next spring. It is estimated that 10,000 acres can be likewise supplied.

There are many scattering orchards about the county, but the places mentioned follow horticulture as their chief occupation.

The accompanying table shows the amount of planting during the past year:

	Citrus— Acres.	Deciduous— Acres.	Olives— Acres.	Total Acres.
Riverside .....	1,088			1,088
South Riverside .....	893	148		1,041
West Riverside .....	208	11	2	221
Alessandro .....	120	95		215
Moreno .....	775	772	183	1,730
Perris .....	100	295	20	415
San Jacinto .....	32	175		207
Banning .....		175		175
Miscellaneous .....	50	100		150
Totals .....	3,266	1,771	205	5,242

Total acreage planted during 1892-93, 5,242 acres.

This general report is submitted with regrets that the short time elapsed since organization prevents a more complete statement of resources and condition.

CHARLES W. GODFREY,  
Secretary.

MORENO, November 8, 1893.

### SAN BENITO COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: I have no particular report of the work of the Horticultural Commissioners for the past season. We have watched closely all trees coming into the county for planting, and have found them clean with one exception; these we had thoroughly disinfected before planting, and they show no signs of scale at present.

We have found orchardists ready and willing, whenever we have discovered orchards infested with scale, to apply the remedies recommended, and the result is that orchards are much cleaner and in better condition than before the organization of the Board.

We shall start out next week to make our annual examination of orchards, and shall strongly urge upon those having apples and pears the necessity of applying the remedies recommended for the codlin moth,



as we have found from personal experience that from 75 to 95 per cent of fruit can be saved if properly and systematically sprayed.

We have no inspectors, as the orchard interests of our county are confined to a very small area, and we have not thought it necessary to appoint inspectors.

The names and addresses of the Board are: George S. Tremaine, San Juan, Secretary; E. W. Bowman, San Juan, President.

Respectfully submitted.

GEORGE S. TREMAINE,  
Secretary.

SAN JUAN, December 8, 1893.

#### SAN BERNARDINO COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: The work of the Board of Horticultural Commissioners of San Bernardino County has been chiefly of a routine character the past year. Some new insects have been found, but so far as observed have not been of a predaceous character. The formation of Riverside County removed from our jurisdiction a section to which we necessarily had to devote considerable attention.

Within the limits of the present county we have found that the black scale has spread and multiplied greatly the past year, especially in the western part. The twice-stabbed ladybird has been invariably found very numerous in the same localities, and there is abundant evidence that they have preyed extensively upon the *Lecanium oleæ*. Disinfection both by gas and spraying would have been almost universally practiced had it not been for the statements made in reference to the *Rhizobius ventralis*, which had the effect of entirely stopping fumigation and largely the same effect with spraying.

Brown scale has not been more numerous than heretofore, which is rather surprising, considering the immense increase in acreage of citrus trees the past two years. Of red scale or yellow scale we have not a single tree known to be infested.

The large quantities of deciduous trees brought into the county for planting the past season showed a marked improvement in freedom from insect pests, a very small percentage showing traces of them. Notwithstanding this, everything was quarantined for examination, and disinfection rigidly enforced.

Root knot was found everywhere. In almost every consignment from the northern counties it was found, and thousands of trees condemned. The wisdom of the course pursued is well established, and from the fact that the growing season has developed the disease on large numbers of trees which showed no traces of it at planting time, raises a question with us whether we shall not quarantine absolutely nurseries in which the disease exists. Some such action forces itself upon us, for the reason that growers cannot afford annually to be subjected to such losses as have been theirs to bear the past two years from this cause. Thousands upon thousands of trees have been uprooted and found affected, and not a small number of the replantings as well.

The plantings the past year have been very large, and promise to be large for the coming season.

Respectfully submitted.

W. E. COLLINS,  
Secretary.

ONTARIO, — — —, 1893.

## SAN DIEGO COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: We herewith submit a partial report of the condition of the fruit interests of the different districts of this county.

Originally the area of this county was about 14,500 square miles, but in the forming of Riverside County over one third of this territory was cut off, yet there remains 8,400 square miles, with a Board of three Commissioners, who were placed in charge of the horticultural interests of this large domain only last May, hence only a very imperfect report can be made, save from the records of other years.

The county embraces a great diversity of climate and soil, with equally diversified products. The present Board, during their first regular meeting, divided the county into three districts, Mr. W. R. Gunnis being given the first district, embracing the city of San Diego and suburban towns and adjacent valleys; Mr. H. Culbertson, of El Cajon, was placed over the second district, and Judson Williams, of Fallbrook, the third, the boundary lines being drawn with reference to the amount of orchards in each district. Mr. Gunnis was chosen President of the Board, and Judson Williams, Secretary.

Immediately after the organization of the Board two members of same were sent, under authority of the County Board of Supervisors, on a tour of inquiry and investigation through some of the adjoining counties, to learn the best methods of fighting insect pests. On the return of these Commissioners they recommended that the county procure fumigating outfits for each of the three districts, which was done, at a cost to the county of something over \$1,200, and a competent corps of inspectors set to work.

The warfare has been and is being waged against the pests with the utmost energy by means of the most improved fumigating appliances, the best washes and pumps, and the introduction of predaceous insects, the first of these insects being the *Vedalia cardinalis*, which in a few short weeks cleared about two hundred trees infested with cottony cushion scale. More recently the *Rhizobius ventralis* has been colonized in several orchards, but the time has been too short to give any reliable reports from it, though it was well demonstrated in the office in San Diego that the full-grown beetle works rapidly and feeds eagerly on the young black scale, the latter being placed in a candy jar where the *Rhizobius* were confined.

In some portions of the county the red spider is becoming one of the most serious of pests, especially to the lemon tree. This is not easily destroyed by hydrocyanic acid gas, but appears to yield to a treatment of sulphur, which may be blown onto the tree with a small bellows, or sifted on from a small bag made of burlap or grain sack.

The codlin moth has gained a foothold in some portions of the county, making it necessary to spray orchards with Paris green each year. But this pest has been kept out of our apple-growing districts, so that perhaps the apples grown in the Julian country and on the plateau of Smith's Mountain—each nearly a mile above sea-level—are as fine as are produced in the United States.

The pernicious scale is quite prevalent in portions of the county, but is being exterminated in some places by fumigating, and in others by some unknown cause, probably a parasite.

The county, through its Supervisors, is standing nobly by the Horticultural Commission in the suppression of these pests, and also in a rigid enforcement of quarantine ordinances. It has been necessary to seize and destroy many boxes of infected fruit and to fumigate hundreds of boxes from districts infested with codlin moth and various scale pests.

Our mountain districts are devoted largely to apple culture, but nearly all deciduous fruits thrive and produce the highest grades of fruit, while some of the valley districts, such as Cajon and Escondido, give preference to deciduous fruits, with good citrus orchards in lands a little elevated above the level of the valleys. On the mesa lands about Fallbrook citrus fruits and the olive take preference over all else, the olive being more extensively planted there, probably, than in any other district of similar area in the State, there being over 800 acres now growing within a few miles of the town of Fallbrook. Next in order comes the lemon, then the orange; yet this country, with the mesas and small valleys near Escondido, and in Bear Valley, produce apples only second to those of the mountain regions. In the district about San Diego Bay the lemon appears to find nearly or quite everything necessary for the production of perfect fruit, and hence it is being extensively planted, but not to the exclusion of the orange and deciduous fruits.

In this district a good deal of work has been done and we send a tabulated report as far as done, but which lacks much of being a full report of *one* district, though probably it will cover 90 per cent of the fruit trees in the territory. This must not be taken as an index of the county, for it probably contains over half of all the citrus trees in the county, while either of the other two districts probably contain twice as many deciduous trees, twice as many olive trees in at least one, and probably four times as many acres in grapes in either the second or third district, the output of raisins from El Cajon and contiguous valleys alone for the present season being over one hundred carloads.

*Report (nearly complete) of District No. 1, of San Diego County.*

Variety.	Number of Acres.			Plant of 1893.
	Bearing.	Non-bearing.	Total.	
Apple.....	91	33	124	10
Apricot.....	145	62	207	15
Cherry.....	-----	1	1	-----
Fig.....	90	36	126	20
Lemon.....	652	3,088	3,740	2,000
Orange.....	552	585	1,137	200
Olive.....	84	35	119	5
Pear.....	59	27	86	10
Peach.....	201	121	322	35
Prune and plum.....	66	84	150	50
Miscellaneous fruits.....	57	30	87	10
Grapes.....	350	-----	350	25
Nuts.....	5	21	26	10
Totals.....	2,352	4,123	6,475	2,390

Nursery stock (trees ready to plant) ..... 1,500,000

Respectfully submitted.

FALLBROOK, — — —, 1893.

JUDSON WILLIAMS,  
Secretary.



## SANTA BARBARA COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: I herewith forward to you my report of work as Horticultural Commissioner of Santa Barbara County, for the year ending September 30, 1893.

The year has been one of great activity among fruit growers and nurserymen. A much greater acreage has been set to trees than in any previous year. During the fall of 1892 the fruit crop was more than an average yield, and the fruit was less affected by insect pests than usual. This was due, in my opinion, to the more careful cultivation given to the soil, more thorough pruning, and a more liberal method of spraying; and the result proved to orchardists that spraying is beneficial, and, as a consequence, a much larger per cent of orchards has been brought under the operation of the spray pump the present year.

Deciduous trees have been subjected to Paris green; some having two or three applications, which remedied the codlin moth.

The larger citrus groves have been liberally treated to the rosin wash, *not once only*, but three or four times since January 1st. Two of these groves, of good extent (the trees twenty-five or thirty years old), were so badly infested with the red scale that I forbade the fruit being brought to market. Since then the trees have been sprayed four times, and are now looking vigorous. The fruit was picked while small and destroyed, thus giving the trees a fine new growth. I also placed a good sized colony of the *Orcus chalybeus* (which you sent me) in each of these two groves.

During last winter and spring nearly 75,000 olive trees were shipped from the nurseries in Montecito and Carpinteria to various parts of this county and to other parts of the State. I required all these to be thoroughly disinfected before shipment, and I personally inspected them; and I believe not one complaint was made by those to whom the trees were sent.

Several thousand citrus trees were sold from the same nurseries, and I believe but two parties have complained of any pests being found upon them.

The black scale often appears upon some orange and lemon trees within six months after planting, although I have personally inspected the same trees at the time of sale and pronounced them clean. I have had two or three such cases in my own garden.

During the year I have inspected more than 200,000 trees, shrubs, plants, flowers, and fruits. I have found the usual pests, such as woolly aphis, codlin moth, the black, red, and white scales, etc., but the *Vedalia* controls the white scale; Paris green and the rosin wash will subdue the aphis, the moth, and many of the other pests; and the *Rhizobius ventralis* and *Orcus Australasia* will divide the black scale between them.

Three or four years ago our fruit industry seemed threatened with destruction, and people from abroad were at a halt about buying land for tree planting. Now there is no hesitancy in setting out either deciduous or citrus orchards, as there is confidence in the remedial agencies at hand for any pests, if properly applied.

I have in two instances found what is called the "elephant beetle," specimens of which I gave to Dr. Lorenzo D. Yates, the President of our Horticultural Society. It is very destructive to citrus trees.

In conclusion, I will say that the prospect is encouraging for a greater number of permanent settlers desirous of entering into the fruit-growing industry than ever before; that the present actual fruit growers are more ready to improve their orchards and bring their fruits to a higher state of perfection. I have required all nurserymen and dealers in trees to demand of those from whom they purchase stock a certificate from the local inspector showing that the stock is clean.

Very respectfully,

T. N. SNOW,  
Horticultural Commissioner for the First District.

SANTA BARBARA, October 31, 1893.

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### SANTA CLARA COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: I have the honor of submitting to you my annual report for Santa Clara County.

The Board of Supervisors of my county appointed me Horticultural Commissioner on December 6, 1892. The county is so well known that I will not go into details in describing it. The leading industries are horticulture and viticulture.

My appointment occurred in planting season, and I was very careful not to allow any stock to be sold unless it was free from pests and fungi. I devoted four months to this work, during which time I destroyed over 2,000 trees.

In April the Supervisors limited my work to only ten days in the month for the remaining eight months. This time I spent investigating the several pests which are found in my county. The most prevalent one is the pernicious scale (*Aspidiotus perniciosus*), which once threatened to ruin our industry, but has now almost disappeared, the cause of which is a small chalcid fly (*Aphelinus fuscipennis*) and the twice-stabbed ladybird (*Chilocorus bivulnerus*). The black scale (*Lecanium oleæ*) and the brown apricot scale (*Lecanium armeniacum*) are both plentiful, but I am glad to report that the brown apricot scale has an enemy, *Comys bicolor*, a chalcid fly, which is doing remarkable work. In some of the districts fully one half, in some three fourths, are killed. As to the black scale, the twice-stabbed ladybird and Pilate's ladybird help to decrease it to some extent, but we expect better results from *Rhizobius ventralis*. The cottony cushion scale is a pest of the past, and only occurs in some gardens and on road trees.

These are the principal scale insects which trouble us. Other pests are the peach borer (*Sannania pacifica*), which has greatly decreased, owing to thorough fighting; the fall cankerworm (*Anisopteryx autumnata*), which exists in some parts of the county, which is due to bad attendance to the bands of printer's ink, not keeping them wet when the moths are hatching. The peach moth (*Anarsia lineatella*) does great damage to young trees, and, as I reported to Mr. Alexander Craw, it can be fought in December or January with kerosene emulsion. The larva is then in the crotch of the trees in minute burrows. The codlin moth (*Carpocapsa pomonella*) is a very serious pest with us, and we have

to fight it with arsenic washes and banding the trees, to secure a good crop of pears or apples. Now and then the flat-headed apple tree borer (*Chrysobothris memorata*) appears, but not alarmingly. The *Diabrotica soror* has decreased very much by its parasite (*Celatoria Crawii*). The cherry slug (*Selandria cerasi*) only occurs in some sections, and the damage is nominal. The prune aphid infests mostly young trees, and is easily fought. The woolly aphid (*Schizoneura lanigera*) occurs in some districts, and is kept in check by the more common ladybirds and lacewing flies. The red spider (*Tetranychus telarius*) is also here, and mostly infests the almond, spreading also to the prune and other trees. It occurs in numbers only in a dry season, and is not a serious pest with us.

In the vineyards the phylloxera has appeared, and infested vineyards are being uprooted.

Next to the insect pests, we have in the county several fungi, which do great damage to trees and fruit. The most prevalent ones are the pear scab, the shot-hole fungus, the curl leaf of the peach, and a new fungus on the apricot, which is not yet determined. All the fungi can be fought with success, and the only difficulty is in the preparation of the washes, which, unfortunately, only one out of ten can make properly.

On the whole, I can say that the pests of the horticultural and viticultural industries are on the decrease, owing to the thorough manner in which the growers spray their trees.

Respectfully submitted.

SAN JOSÉ, November 1, 1893.

EDWARD M. EHRHORN,  
Horticultural Commissioner.

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#### TEHAMA COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: I herewith send you my report as Secretary of the Tehama County Board of Horticultural Commissioners, for the year ending September 30, 1893.

At the regular meeting of said Board E. Crotzer was elected Chairman, and G. H. Flournoy Secretary. The county was divided into three districts, as follows: All that portion of the county north of Redbank Creek, on the west side of the Sacramento River, and all of that portion on the east side of said river north of Mill Creek, except Berendos, was designated as District No. 1, and President E. Crotzer placed in charge of the same. Berendos was designated as District No. 2, and Prof. O. E. Graves was placed in charge of said district. The remaining portion of the county was designated as District No. 3, and assigned to G. H. Flournoy.

Many of the orchards and vineyards have been inspected, and in some of them pests have been found. The horticulturists all seem anxious to destroy all pests, but the Chinese, as a rule, are careless and neglectful. We intend to see that the law is rigidly enforced the coming winter.

Some of the orchards on Thomes Creek that were infested with scale several years since are now almost entirely clear of them.

The codlin moth is less destructive than in 1891 and 1892. Trees and vines planted the past season were clean, and have done well the past summer.



If the law were enforced half as well as the State Quarantine Officer seems desirous it should be, the horticulturists of Tehama County would have but little to fear from pests of any kind.

Respectfully submitted.

G. H. FLOURNOY,  
Secretary.

HENLEYVILLE, 1893.

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### TULARE COUNTY.

*To the honorable the State Board of Horticulture:*

GENTLEMEN: I beg leave to hand your honorable Board my report for 1892 and 1893. During the planting season of December, January, and February last, I prohibited any trees from being planted in my district of Tulare County, unless they were sound both in root and top and entirely free from insect pests. I quarantined one lot of Winter Nelis pear trees (eleven hundred) affected with diseased roots, which lot was entirely destroyed by fire later on.

There was a nursery firm in our neighboring county of Fresno, that brought into that county two carloads of Eastern peach trees by procuring a certificate of inspection from one of that county's Horticultural Commissioners. Some of those trees were planted in the edge of our county. The affidavit accompanying the certificate stated that they were home-grown stock. I have marked the lots and the orchards and will keep posted on the outcome.

In my inspection of orchards last spring I found the brown-necked ladybird (*Scymnus marginicollis*) very numerous in some localities, and they seem to have cleaned the scale out pretty well. They have spread over a large area. It might be said with truth that Tulare County is comparatively free from the pernicious scale.

Orchards and vineyards were afflicted with cutworms very badly. Hand picking seemed to be the most effective remedy. It was my observance that wherever vineyards had been plowed in the fall and then again in the spring they were not troubled with cutworms, although others alongside of them not treated that way were.

We had the usual army of red spider to contend with. Sulphur applied properly and at the right time is most effectual.

The codlin moth has been bad in certain localities, but as the apple grower is now well informed about the remedy, I hope to hold the moth in check.

The *Lecanium hesperidum* scale appeared on some lemon trees, and specimens were sent to your office. The liquid spray material recommended by you was used and the scale disappeared.

The condition of our orchards and vineyards generally is very healthy and the crops produced were good ones, of most excellent quality. The fall season has been one of the best to produce well-ripened wood, and the prospects of another season's crop are unusually good. Number of trees in bearing, 231,732; non-bearing, 124,892. Number of acres in vines, 7,483. They are divided as follows:

Variety.	Bearing.	Non-Bearing.
Apple.....	6,402	2,360
Apricot.....	49,500	4,700
Cherry.....	100	300
Fig.....	1,800	2,700
Peach.....	92,000	54,000
Pear.....	10,140	7,160
Prune (French).....	42,000	28,000
Prune (other kinds).....	8,500	9,600
Lemon.....	540	6,960
Orange.....	2,900	8,412
Almond.....	750	700
Totals.....	231,732	124,892

<i>Grapes.</i>		
Table.....		960
Raisin.....		6,208
Wine.....		315
Total.....		7,483

I have made the report of the entire county on acreage and trees. The trees are planted at irregular distances apart, and for that reason I have put down the number of trees and not acreage.

All of which is respectfully submitted.

VISALIA, November 1, 1893.

C. J. BERRY,  
Horticultural Commissioner.

*To the honorable State Board of Horticulture:*

GENTLEMEN: Herewith please find my report as Horticultural Commissioner of Tule River District, Tulare County, for the year ending October 1, 1893.

During the early spring months I visited all the orchards in my district. I found on Tule River very few large orchards. A majority of the farmers have but few trees. Some of the old trees have pernicious scale. The owners of the large orchards in most cases complied with the law, but the small farmers neglected to do so, owing to the fact that they had no spray pumps at their disposal.

The Horticultural Society of Porterville, late in the season, bought a spraying outfit, which they propose to let the people use, and this year they will have no excuse for not spraying, and will be required to do so. I know of but one young orchard that has scale. The owner will thoroughly disinfect his trees in early spring.

The orange and lemon trees in my district are all free from insect pests, and are in a very healthy condition. There were planted in the neighborhood of Porterville 30,000 orange and lemon trees, all of which have made good growth.

At Lindsay, eight miles north of Porterville, there were planted 20,000 orange and lemon trees, which have done well.

I have inspected all trees that have come into my district, and have found them clean and in good condition.

Respectfully submitted.

PORTERVILLE, November 7, 1893.

R. H. McDONALD,  
Horticultural Commissioner.

## VENTURA COUNTY.

To the honorable State Board of Horticulture:

GENTLEMEN: We have the honor to submit our annual report of the condition of the fruit interests; what is being done to eradicate insect pests, etc., in Ventura County.

In a general way the fruit interests are in first-class condition. The county has a great variety of fruits of the finest quality, having received more awards in this line at the World's Columbian Exposition than any other county in the State.

We were fortunate in having a good county ordinance, and a well-organized Commission before any of the more serious citrus pests obtained a foothold in the county. A few citrus trees infested with red scale have been shipped or hauled into the county and planted, but they were discovered before the scale had spread to other trees, and were burned to ashes. We intend to treat all new pests in this way, at least until a parasite is found that will make them harmless. A local inspector lives within a few rods of each depot in the county, and consignees are required to notify the inspector within twenty-four hours of the arrival of trees, plants, fruit, etc.

Citrus trees in the Ojai and Sespe Valleys are almost entirely free from any kind of scale. Occasionally a little "soft brown scale" appears in a sickly condition, with two parasites feeding on them, viz.: *Encyrtus flavus* and *Coccophagus lecanii*. Nearer the coast citrus trees are infested with black scale, and at Ventura they are also infested with *Lecanium hemisphericum*. Several colonies of the new ladybird (*Rhizobius ventralis*) have been placed on these scales, and their progress will be reported next season.

We have just found some lemon trees infested with yellow scale (*Aspidiotus citrinus*) on both sides of Rincon Creek, which is the line between Santa Barbara and Ventura Counties. The infested trees are in an isolated location, and the scale has been there for some time without its parasite.

All kinds of deciduous fruits do well in this county, and many localities are entirely free from pests. Other localities have a great variety; the codlin moth, pernicious scale, woolly aphis, greedy scale, and red spider are all so well established in the county that we cannot hope to exterminate them. The codlin moth is slowly but surely spreading in several localities. Pernicious scale, greedy scale, and red spider are found in many places, but are kept down with the winter rosin wash. The woolly aphis is quite bad in some localities and hard to fight, many fruit growers preferring to dig up their infested trees. The vine disease did not make its appearance in this county, and what few vineyards we have are producing good crops of the finest grapes.

Respectfully submitted.

J. F. McINTYRE,  
Secretary.

FILLMORE, September 30, 1893.



## YOLO COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: I beg herewith to present the following as my report for the year 1893:

In the Capay district there are approximately 600,000 fruit trees, and I have examined 310,000 during the year.

In my district I found scale in several orchards, and recommended spraying. I find that the summer heat in this locality kills great numbers of all kinds of scale, and I do not think we would be in danger from these pests if we did nothing, but think it best, however, to take the safest plan and spray thoroughly.

Codlin moth I have found in all apple orchards examined. I have recommended the use of Paris green. I have also advised the cutting down and burning of all old and diseased trees afflicted with other pests, as I find it impossible to do anything with them.

Pear slugs are very common, but we have checked them with Paris green. We are troubled greatly with twig borer on our young peach trees.

Root knot is quite prevalent on almond trees, and many have died from its effects.

Red spider is so common that many do not try to rid their orchards of this most injurious pest. Last summer I recommended, by your advice, the use of sulphur thrown on the trees with a common seed-sower. The good effects of this method are readily seen.

Last winter many trees died from sour sap. Almonds were more affected than any other kind. I have for the last three or four years been experimenting with this disease, and am now sure I have the remedy. The soil must not be plowed away from the roots, so as to expose them to the heat of the sun in the early spring. Last winter I had almond trees that stood for two weeks in eight inches of water, and not one died, but as soon as the water went down I banked the dirt twelve inches high around the body of the tree and left it remain there till the first of May.

No steps have been taken by this Board toward the regular inspection of young trees coming from California nurseries for planting, and we would like your advice on this matter.

I remain, very respectfully yours,

W. E. COLE,

CAPAY, November 4, 1893.

Horticultural Commissioner.

## YUBA COUNTY.

*To the honorable State Board of Horticulture:*

GENTLEMEN: Since my last report I have proceeded with the work of inspecting and spraying the infested orange trees in the city of Marysville. Have visited on several occasions and have made inspections of the local nurseries, and I have found some little scale. I have called the owners' attention to it, and they promise to attend to it.

At Wheatland careful inspections were made, and I found growing several thousand deciduous trees in one of the nurseries with some signs

of the pernicious scale, and the owners promised to take steps to eradicate it, as they were anxious to have only clean stock.

While at Wheatland I appointed Mr. John King inspector for Wheatland and vicinity. He reports the finding of black scale on certain trees, and that he had notified the owners.

It will be quite necessary to maintain an inspector at Wheatland from the present time until the next planting season, as there are fears that importations of Eastern peach trees infested with the "yellows" may arrive at that station. It is the intention of the Horticultural Commissioners to watch with the utmost care every importation of Eastern trees and plants during the coming season, in order to prevent any new tree diseases from being brought into the county.

I have arranged to take care of any shipments that may arrive at the Marysville station, and the inspector appointed at Wheatland will look out for that station. Should more inspectors be required, I will appoint them. The orchards in the northern part of the county and in the Brown's Valley irrigation district that I recently inspected, I found free from injurious scale.

I find that notwithstanding the expensive and strenuous efforts that were made to rid the trees of the yellow scale, there are signs of it returning. I have, however, received assurances from the owners of infested trees that immediate attention will be given, and that the trees will be treated.

In that section of the county in the vicinity of Wheatland is the Colmena Colony. I made a series of careful inspections. There are now no signs whatever of scale insects in the Colmena orange groves, and I am to keep a careful watch over this district to prevent the yellow scale from securing a lodgment there. Near the town of Wheatland I inspected several orchards, and a nursery. On one side of the nursery there stands an orchard that is badly infested with the pernicious scale, which has already commenced to work its way into the nursery, two rows of the young trees being now slightly infested. With the exception of these two rows I find the nursery quite free from scale insects.

Official notices are in course of preparation to be forwarded to the owners of infested trees in and around Wheatland, and every effort will be made to induce them to take the proper steps to eradicate the destructive pests.

During the months of January and February (1893) particular attention was paid to the inspection of nursery stock. All the stock of trees in nurseries within the county and all importations of trees by rail or otherwise were carefully inspected. Special trips were made to Wheatland and Colmena Colony. Inspections of all deciduous trees placed on sale in the temporary sale yards in Marysville were made, and where no insect pests were found, certificates of inspection were granted. The citrus trees growing in the gardens and groves in Marysville were examined and many thousands of them sprayed with the rosin solution.

Inspection work in a Wheatland nursery resulted in the discovery of about one hundred slightly infested trees. These were destroyed. No scales were found at the Colmena Colony. In another nursery very slight traces of yellow scale were found. On notification, the owner promptly disinfected the trees with a rosin-soap solution. The yellow scale that once infested one of our nurseries is gradually disappearing, owing to efforts that have been put forth for its eradication.

Several lots of small citrus trees standing in nursery rows in the various yards in Marysville, and offered for sale, were found infested with the yellow scale. The owners were notified of the existence of the scale, and they promptly complied with a request to disinfect.

About one hundred bales, bundles, and boxes of trees, including a vast number of deciduous seedlings from France, and shipments from various nurseries throughout the State, arrived at the depot in Marysville during January and February. Many of the shipments were in transit to other counties, but a careful watch was kept in order to ascertain if any attempt was being made to import trees from the "yellows" infested districts in the Eastern States. After inspections had been made among the Marysville orange trees, notices were sent to the owners of the infested trees. As a result of the sending of this notice, many hundreds of trees were sprayed.

It gives me pleasure to report that there seems to be a growing desire on the part of the Marysville owners of citrus trees to rid them of the pestiferous "yellow scale" that has so long infested them.

During January and February the work consisted of inspection of all importations of trees that arrived at the depot in this city; inspections of citrus and deciduous fruit trees throughout the county and in the city of Marysville; special inspection work at the Wheatland nurseries through the Deputy Commissioner, J. King; inspection of all trees brought into the Brown's Valley district, and inspection and disinfection work at the Excelsior Water Company's orchard, near Smartsville.

During March and April about 7,500 olive trees and about 7,000 orange trees arrived at the Marysville railway depot. These trees were all inspected at the depot, in as complete a manner as it was possible to do without unwrapping them from the bundles in which they were shipped. Memoranda of their destination within the county were kept, and each lot was afterward thoroughly inspected at the place of planting, when taken from the wrappings.

Among the several lots of trees there were two lots found infested with scale; one, a mixed bundle of Florida orange and olive trees shipped through a nursery at Niles, was found to be infested with purple and black scales. The nursery was notified, and the shipment was withdrawn from Yuba County. The other lot consisted of some 3,500 orange trees from a nursery at Haywards. These trees were sent into Yuba County on the certificate of an inspector at Haywards, but when they were inspected were found to be infested with black scale. They were immediately quarantined, and the shipper notified. It was decided that the trees could be passed and allowed to be planted when they were properly disinfected. This was done by severely trimming the tops of the trees and dipping the trunks in a whale-oil soap solution, which operation was superintended by your Commissioner.

All the citrus trees in the city of Marysville were inspected and the work of spraying them was finished.

During March and April I visited and inspected the orange groves and orchards northeast of Marysville and the various new plantings in the Brown's Valley irrigation district. In those orchards and places where scale was found the proper remedies were given to the owners to be applied for the destruction of the pests. In an orchard northeast of Marysville traces of pernicious scale and signs of the codlin moth were found. Upon suggesting to the proprietor that the trees should be



sprayed, he gave orders to have the work done. A number of applications for recipes for manufacturing various washes to be applied as remedies for the destruction of scale on fruit trees were received at the Commissioners' office. These recipes were supplied in each case without any cost or charge of any kind to the county.

When the trees in the Wheatland nursery were being dug up for shipment it was necessary to have some one stationed there to see that the infested trees were not shipped out. Some 23,000 trees were looked over and about 1,500 were found to be infested. These were burned or otherwise destroyed, none but clean trees being sent out. All the orchardists whose places were infested were officially notified that it would be necessary to spray the trees, which they consented to do.

During May and June inspections were made of an importation of olive trees arriving at the depot in this city, the orange and deciduous orchards at the Colmena Colony, the orchards at the Olive Hill Colony, the newly planted trees at the Bernouli Swiss Colony, in the Brown's Valley irrigation district, and the nurseries and citrus trees in the city of Marysville.

Importations of olive trees were found in good order and free from scale. At Colmena Colony some traces of the soft orange scale were discovered on a few of the orange trees, but in such small quantities that it was easily destroyed. At Olive Hill Colony no signs of scale were discovered, but an incipient outbreak of the grasshopper pest was found to be well under control of the colony managers. The grasshoppers were of the devastating species, but they were not nearly so numerous as in former years; they were easily kept in check by the following remedy: One part, by weight, of arsenic; one part sugar to six parts bran; to which is added a sufficient quantity of water to make a wet mash. The mixing is done in tubs or half barrels. One of these is filled about three fourths full of dry bran, to which is added five pounds of arsenic (Paris green), which is thoroughly stirred through the dry bran with a wooden paddle or shovel. Five pounds of sugar is then dissolved in a pail of water, and this sugared water is mixed with the bran and arsenic, to which is added a sufficient quantity of water to moisten the whole. A teaspoonful of the mixture is placed near the root of each tree or vine. Allowing a teaspoonful of the mixture to each vine in an infested vineyard (the vines being set seven or eight feet apart), about ten pounds of bran, with arsenic and sugar in proportion, would be used, making the cost about 15 cents per acre. This mixture should not be put out where the domestic animals can have access to it, and great care should be used in handling it. The mixing should be done in a closed room, to prevent the flying about of the arsenic. Where it would not be safe to use the poisonous mixture the trees may be sprayed with the following preparation: One pound of buhach, three pounds of glucose, to ten gallons of water. The glucose should be first dissolved in hot water. This solution should be sprayed on the trees late at night, and when the locusts fall to the ground, stupefied by the mixture, they should be gathered up and destroyed. Many remedies have been tried from time to time, such as burning sulphur on the windward side of the orchard or vineyard; piling brush in the orchard and burning late at night, but none have proved so successful as the above mentioned. In the case of young vineyards, where the leaves have been eaten off, plowing under so that the vines are covered with a thin coating of earth, will save them.

In the course of three or four weeks they will send up new shoots. Covering the vines with paper bags has been tried, but in many instances the locusts have eaten through them.

The grasshopper in its native wilds is subject to the attacks of a tiny red insect or parasite, which by clinging to the grasshopper often retards its flight, and by sucking out its juices, kills it. In many of the specimens that I examined I found several of the parasites, and I believe that the work of this tiny red parasite has had the effect of preventing much destructive work by the grasshopper this year.

In July and August I visited the Olive Hill Colony, the Colmena Colony, the Smartsville district, also the orange trees and groves in the city of Marysville. At the Olive Hill Colony reports of the existence of scale on the trees at the McMillan place were brought to me, with the statement that the trees should probably be cut down and destroyed. A careful examination of branches taken from the infested trees showed that the trees were infested with the soft orange scale. I prescribed the proper remedy. My suggestions were carried out, and the trees are in good condition to-day. I also went through the groves at the Olive Hill Colony and carefully examined all the trees, but found no signs of any destructive insects.

In the Smartsville district I examined the trees in the town of Smartsville and those growing on the Bonanza ranch. I found some signs of the yellow scale at Smartsville, but the trees that I was called to particularly inspect were free from scale. The trees on the Bonanza ranch I found to be in a thrifty condition, with the exception of those that were quarantined in the early part of this year, on account of being infested with the black scale. These trees have not made satisfactory growth, which is attributable to the severe manner in which they were treated at the time they were taken from the nursery. The trees were completely rid of the black scale.

In the city of Marysville I made a series of careful inspections and found signs of the yellow scale returning, whereupon I issued a notice and forwarded a copy of the same to all owners of the badly infested trees.

The request contained in this notice was and is being generally complied with, which will have the effect of keeping the trees in good condition so far as the depredations of injurious insects are concerned.

I also visited and made a number of inspections in the Wheatland district, examining by request the hop fields for aphids, none of which I found. The orchards in and around Wheatland are in a very clean and thrifty condition.

Respectfully,

G. W. HARNEY,  
Horticultural Commissioner.

MARYSVILLE, September 1, 1893.

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# REPORT FOR 1894.

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# REPORT.

To his Excellency H. H. MARKHAM, Governor:

In accordance with law, we have the honor to submit herewith our report for the year 1894.

## INSPECTION OF STEAMERS.

All steamers and sailing vessels that arrive at the port of San Francisco are boarded by an authorized officer, and all plants and trees found on them are carefully inspected, and when any are found infected with scale or any other insects injurious to fruit or fruit trees, they are immediately disinfected or destroyed. The following is a list of vessels that arrived at the port of San Francisco from January 1 to June 30, 1894, having plants and trees on board:

1894.	Vessels.	From—	Contents.	Disposition.
Jan. 1	Gaelic .....	China and Japan..	19 plants.....	3 destroyed.
Jan. 6	Columbia .....	Portland, Or.....	7 bundles trees .....	Clean.
Jan. 9	City of Sydney..	Central America..	3 plants .....	Clean.
Jan. 12	City of Peking..	China and Japan..	3 plants .....	Destroyed.
Jan. 12	Australia .....	Honolulu .....	35 packages trees .....	Disinfected.
Jan. 17	Columbia .....	Portland, Or.....	1 bundle trees .....	Clean.
Jan. 18	China .....	China and Japan..	152 cs. plants, bulbs .....	Plants fumigated.
Jan. 18	San Juan .....	Central America..	10 plants .....	Clean.
Jan. 20	Monowai .....	Australia .....	24 plants .....	Disinfected.
Jan. 26	Columbia .....	Portland, Or.....	1 bundle trees .....	Clean.
Jan. 27	Belgic .....	China and Japan..	54 cases plants .....	Fumigated.
Feb. 2	San Blas .....	Central America..	6 plants .....	Clean.
Feb. 7	Peru .....	China and Japan..	142 cases .....	Fumigated and others dipped, 120 dest'yd.
Feb. 10	Australia .....	Honolulu .....	9 plants .....	Clean.
Feb. 16	Alameda .....	Australia .....	45 packages plants .....	Disinfected.
Feb. 20	San José .....	Central America..	5 cocoanut palms .....	Clean.
Feb. 22	Oceanic .....	China and Japan..	4 packages plants .....	Disinfected; 108 trees destroyed.
Feb. 27	Rio de Janeiro..	China and Japan..	17 pkgs. plants .....	Disinfected.
Mar. 2	Acapulco .....	Central America..	3 palms .....	Clean.
Mar. 9	Gaelic .....	China and Japan..	36 cases plants .....	Fumigated.
Mar. 10	Australia .....	Honolulu .....	7 ferns .....	Clean.
Mar. 15	Mariposa .....	Australia .....	9 ferns .....	Clean.
Mar. 20	City of Peking..	China and Japan..	15 cases plants .....	Fumigated; 16 plants destroyed.
Mar. 23	San Juan .....	Central America..	1 case orchids .....	Clean.
Apr. 1	China .....	China and Japan..	3 boxes plants .....	Disinfected; 4 plants destroyed.
Apr. 7	Australia .....	Honolulu .....	3 boxes plants .....	Disinfected.
Apr. 8	Belgic .....	China and Japan..	5 cases plants .....	Disinfected.
Apr. 17	Peru .....	China and Japan..	5 pkgs. plants .....	Disinfected.
Apr. 18	Monowai .....	Australia .....	2 boxes plants .....	Disinfected.
Apr. 18	San José .....	Central America..	2 coffee, 2 palm trees .....	Clean.
Apr. 28	Oceanic .....	China and Japan..	5 cases plants .....	Fumigated; 12 orange trees destroyed.
May 2	Acapulco .....	Central America..	3 boxes plants .....	Clean.
May 5	Australia .....	Honolulu .....	2 boxes plants .....	2 palms, 2 ferns with wax scale destroyed.
May 6	Rio de Janeiro..	China and Japan..	13 pkgs. plants .....	Disinfected.
May 10	Alameda .....	Australia .....	3 pkgs. ferns .....	Clean.
May 15	San Blas .....	Central America..	3 ornamental plants .....	Clean.

1894.	Vessels.	From—	Contents.	Disposition.
May 21	Gaelic -----	China and Japan--	12 ornam'tal plants	Destroyed 6 orna- mental plants and 2 orange trees.
May 27	City of Peking --	China and Japan--	5 palms -----	Clean.
June 2	Australia -----	Honolulu -----	4 ornam'tal plants.	Destroyed.
June 4	China -----	China and Japan--	4 cases plants -----	Fumigated.
June 7	Mariposa -----	Australia -----	7 boxes ferns -----	Clean.
June 18	San José -----	Central America--	1 case orchids -----	Clean.
June 18	Belgic -----	China and Japan--	1 crate plants -----	23 plants destroyed.
June 30	Australia -----	Honolulu -----	7 palms -----	Disinfected.
June 30	Acapulco -----	Central America--	Banana plants and acacias.	Clean.

## HORTICULTURAL QUARANTINE REGULATIONS.

At a meeting of the State Board of Horticulture, held in San Francisco, August 15, 1894, the following regulations were adopted, in accordance with the laws regulating such matters, and are therefore binding upon all persons:

## REGULATIONS

*Amending all existing regulations hitherto passed, and to take effect and be in force from and after August 15, 1894.*

RULE I. All consignees, agents, or other person or persons, *shall*, within twenty-four (24) hours, notify the Quarantine Officer of the State Board of Horticulture, or a duly commissioned Quarantine Guardian, of the arrival of any trees, plants, buds, or cions at any point of debarkation in the State of California.

RULE II. All trees, plants, cuttings, grafts, buds, or cions, imported or brought into the State from any foreign country, or from any of the United States or Territories, are hereby required to be disinfected, as hereinafter provided, upon arrival at any point where they are to be unloaded; and furthermore, if any of said trees, plants, cuttings, grafts, buds, or cions are found infested with insects, or with any fungi, blight, or other disease injurious to fruit or to fruit trees, or to other trees or plants, they *shall* remain in quarantine fourteen (14) days, or until the Quarantine Officer of the State Board of Horticulture, or a duly commissioned Quarantine Guardian, can determine whether the said trees, plants, cuttings, grafts, buds, or cions are free from live injurious insect pests, or their eggs, larvæ, or pupæ, *before* they can be offered for sale, gift, distribution, or transportation.

RULE III. All trees, plants, cuttings, grafts, buds, or cions infested with any insects, fungi, blight, or other diseases known to be injurious to fruit or to fruit trees, or to other trees or plants, and liable to spread contagion, *are* hereby required to be disinfected before being offered for sale, gift, removal, distribution, or transportation.

RULE IV. All peach, nectarine, apricot, plum, or almond trees, and all other trees budded or grafted upon peach stocks or roots, all peach or other pits, and all peach, nectarine, apricot, plum, or almond cuttings, buds, or cions, raised or grown in a district where the "peach yellows" or the "peach rosette" are known to exist, are hereby prohibited from being planted or offered for sale, gift, or distribution within the State of California.

RULE V. All trees, plants, cuttings, grafts, buds, cions, seeds, or pits arriving from any foreign country, found infested with insect pests or their eggs, larvæ, or pupæ, or with fungi, or other disease or diseases hitherto unknown in this State, *are* hereby prohibited from landing.

RULE VI. Fruit of any kind grown in any foreign country, or in any of the United States or Territories, found infested with any insect or insects, or with any fungi, blight, or other disease or diseases, injurious to fruit or to fruit trees, or to other trees or plants, *is* hereby prohibited from being offered for sale, gift, or distribution within the State.

RULE VII. Transportable material of any kind, infested by any insect or insects, or their eggs, larvæ, or pupæ, or by any fungi, blight, or other disease or diseases known to be injurious to fruit or to fruit trees, or to other trees or plants, and liable to spread contagion, *is* hereby prohibited from being offered for sale, gift, distribution, or transportation, until said material has been disinfected by dipping it in boiling water and allowing it to remain in said boiling water not less than two minutes; such boiling water used as such disinfectant to contain in solution one pound of concentrated potash to each and every ten gallons of water.



**RULE VIII.** All trees, plants, cuttings, grafts, buds, or cions may be disinfected by dipping in a solution of three fourths of a pound of whale-oil soap (80 per cent) to each and every gallon of water; said whale-oil soap solution *shall* be kept at a temperature of 100° to 115°. Said trees, plants, cuttings, grafts, buds, or cions shall remain in said solution not less than two minutes. After said trees, plants, cuttings, grafts, buds, or cions have been disinfected they *shall* remain in quarantine fourteen (14) days for subsequent inspection, and if deemed necessary by the Quarantine Officer of the State Board of Horticulture, or a duly commissioned Quarantine Guardian, for further disinfection.

**RULE IX.** All trees, plants, cuttings, grafts, buds, or cions may be disinfected by fumigation with hydrocyanic acid gas, as follows: Said trees, plants, cuttings, grafts, buds, or cions *shall* be covered with an air-tight tent or box, and for each and every one hundred cubic feet of space therein, two thirds of an ounce of C. P. cyanide of potassium (98 per cent), one fluid ounce of sulphuric acid, and two fluid ounces of water shall be used. The cyanide of potassium shall be placed in an earthenware vessel, the water poured over the said cyanide of potassium, afterwards adding the sulphuric acid, and the tent or box to be immediately closed tightly, and allowed to remain closed for not less than forty minutes. After said trees, plants, cuttings, grafts, buds, or cions have been treated with hydrocyanic acid gas, as above directed, they *shall* remain in quarantine for fourteen (14) days for subsequent inspection, and if deemed necessary by a member of the State Board of Horticulture, or the Quarantine Officer of said Board, or a duly commissioned Quarantine Guardian, for subsequent disinfection.

**RULE X.** All trees, plants, cuttings, grafts, buds, or cions imported or brought into this State *shall* be inspected upon arrival at first point of debarkation, and if found infested with mining scales (*Chionaspis biclavis*) or other injurious insects which cannot be destroyed by the remedies required in Rules VIII and IX of these regulations, *are* hereby prohibited from being planted or offered for sale, gift, or distribution, and shall be proceeded against as a nuisance.

**RULE XI.** Any person or persons having in their possession trees, plants, cuttings, grafts, buds, cions, seeds, or pits infested with any insect or insects, or with any fungi, blight, or other disease or diseases injurious to fruit or to fruit trees, or to other trees or plants, and who refuse or neglect to disinfect the said trees, plants, cuttings, grafts, buds, cions, seeds, or pits, as is required by Rules VIII and IX of these regulations, after having been notified to do so by a member of the State Board of Horticulture, the Quarantine Officer of said Board, or a duly commissioned Quarantine Guardian, the said trees, plants, cuttings, grafts, buds, cions, seeds, or pits shall be declared a public nuisance, and shall be proceeded against as provided for by law.

**RULE XII.** Animals known as flying-fox, Australian or English wild rabbit, or other animals or birds detrimental to fruit or fruit trees, plants, etc., *are prohibited* from being brought or landed in this State, and if landed they *shall* be destroyed.

Passed at a regular meeting of the State Board of Horticulture, at San Francisco, California, August 15, A. D. 1894.

#### FINANCIAL STATEMENT.

The following are the expenditures incurred during the forty-fifth fiscal year, ending June 30, 1894:

Stenographer.....	\$306 25
Office furniture.....	91 90
Papers.....	31 10
Library.....	86 50
Janitor.....	236 60
Postage.....	395 75
Cartage.....	61 05
Freight.....	18 18
Wood-cuts and electrotypes.....	436 74
Lithographing.....	150 00
Miscellaneous printing.....	169 90
Traveling expenses of Commissioners.....	626 85
Salaries of Special Agents.....	894 50
Traveling expenses of Special Agents.....	91 25
Traveling expenses of Quarantine Officer.....	375 10
Traveling expenses of Deputy Quarantine Officer.....	20 40
Traveling expenses of Secretary.....	200 45
Salary of Deputy Quarantine Officer.....	69 00
Sketches and drawings.....	561 82
Office supplies.....	156 72
Rent.....	1,645 00
Repairs.....	23 40
Expressage.....	117 40
Experimenting.....	576 72

Midwinter Fair exhibit.....	\$2,077 11
Sundries .....	193 40
Seventeenth State Fruit Growers' Convention .....	183 35
Telegrams and telephone.....	203 55
Total .....	<u>\$9,999 99</u>

Very respectfully,

ELLWOOD COOPER,  
L. W. BUCK,  
FRANK A. KIMBALL,  
J. L. MOSHER,  
A. BLOCK,  
FRED C. MILES,  
SOL. RUNYON,  
I. H. THOMAS,  
A. F. WHITE,  
Commissioners.

B. M. LELONG,  
Secretary, and Chief Horticultural Officer.

Subscribed and sworn to before me, at San Francisco, Cal., September 18, 1894.

[SEAL.]

DANIEL HANLON,  
Notary Public.

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REPORT  
OF  
B. M. LELONG,

Secretary, and Chief Horticultural Officer.

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# REPORT OF B. M. LELONG,

Secretary, and Chief Horticultural Officer.

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## REVIEW OF THE FRUIT SEASON, 1894.

The present fruit season has been one of mixed good and ill. It opened with excellent promise. In many localities varieties have suffered from climatic or other causes, but on the whole the season can be reported as prosperous. Taking the State as a whole, the fruit crop may be said to be generally large in yield, while the quality is above the average. Prunes are the only fruit that will fall below the average in the State, although the large area of new orchards which are coming into bearing will bring up the crop to within 30 per cent of the usual annual output.

### THE ORANGE CROP.

The most serious setback in the fruit season occurred on January 6th, when a severe frost swept over the citrus section of Southern California, damaging the greater part of the crop and very materially affecting the price of such fruit as escaped uninjured. The freeze did not come unannounced, and was anxiously looked for by the growers, who noted the dropping of the mercury with the keenest apprehension. By ten o'clock on the evening of the 6th the mercury at Riverside had dropped to the freezing point and was still slowly falling. The danger line had been reached, but when at midnight the temperature remained stationary for some time and then rose several degrees, it was hoped that the worst was passed. The orchardists who were anxiously watching the fate of their crops were doomed to disappointment, however, for at two o'clock the mercury had dropped to 24° and before morning had fallen even lower. Every effort to save the crop was made. Some orchards were flooded in order that the evaporation might overcome the low temperature; in others, fires had been kindled, and various other devices were resorted to to rescue some portions of the crop from the threatening danger, but in spite of all efforts the injury was very severe, the loss in San Bernardino and Riverside Counties alone footing up nearly half a million dollars. Sections which had previously been regarded as absolutely free from danger in this regard were caught and their crops injured. It was at first thought that the loss would foot up 75 per cent or even more, but subsequent developments showed these estimates as greatly over the mark, and as nearly as can be ascertained the total direct loss did not exceed 20 per cent. There was, however, an indirect loss, which fell heavily upon the growers. The report had gone abroad that the entire orange crop was ruined, and when Southern California oranges appeared in the market they were regarded with suspicion, and really good fruit was sold in direct competition with that which had been frosted and which was forced upon the market by unscrupulous shippers, to whom the immediate dollar was of more importance than

their own reputation or that of the section in which they lived. The result of this was that fruit injured and uninjured, alike, brought very low figures, and in many instances the growers' losses were very severe. The total output from Southern California was about 4,000 carloads—20 per cent below the shipments of 1892.

In the northern counties no damage was done by frost, and the yield was at least up to the average. This section is comparatively young in citrus production, the great bulk of this fruit growing south of the Tehachapi range. However, along the entire foothill belt of the Sierra Nevada range, aligning both the San Joaquin and the Sacramento Valleys, are very extensive tracts which are now being devoted to oranges, lemons, and other citrus fruits, and in the next few years the "Northern Citrus Belt" will become a very sharp competitor with the south for the Eastern citrus market. The total absence of frost in many of these sections has given a strong impetus to the industry, and already extensive Eastern shipments have been made from the "Northern Citrus Belt."

Another factor which militated against California's orange market in the East, and resulted in a depression of prices, was that the Florida season, which is usually over before California fruit reaches the market, was unusually late, and her fruit came in direct competition with that from this State. Florida, too, had an extraordinary large crop of fruit, and her growers were so anxious to dispose of it that they seemed willing to let their goods go at any figure which was offered. These causes combined have had a somewhat depressing effect upon the California orange grower. At the present writing, however, a better feeling prevails, the trees are setting heavily with fruit for next season's crop, and it is not probable that such a combination of causes will occur to depress the orange market again for some time at least.

The necessity for unanimity of action among the orange growers, in order that profitable returns for their product should be had, forced itself upon them some time since, and resulted in the organization of the Southern California Fruit Exchanges, and to this is largely due the fact that the growers of citrus fruit have been able to market their products this year without absolute loss. Considering all things—the frost, the financial depression, and the natural opposition of dealers—the Southern California Fruit Exchanges have made a most excellent record for the year.

The report of W. A. Perry, the manager of the Exchanges, is given below:

RIVERSIDE, CAL., June 12, 1894.

*To the Officers and Members of the Riverside Fruit Exchange:*

It is impossible to give a detailed statement of the affairs and conditions of the Exchange at this time. There have been shipped about 1,333 cars to date. There remains in Riverside about 40 carloads.

We have paid over to the various associations up to date, \$336,995 50. There are probably about 175 carloads that have been shipped yet to be accounted for, which should amount to \$46,600, which would amount to about \$383,595 50, with over 40 cars on hand.

Associations Nos. 3, 4, 5, 11, and 12 have shipped all their fruit for the season. The balance of 40 cars still remaining in Riverside will be shipped from Associations Nos. 6, 7, 8, 9, and 10. At the present rate of shipping, these 40 cars will all be forwarded within the next ten to fifteen days.

Up to the present time we have paid out on our brokerage account about \$25,000; on balance of expense account, \$14,000. Our brokerage and expense accounts include all expenses incurred, such as organization expenses, expenses of traveling men, Eastern representatives, brokerage, cash discounts, commissions paid auction houses in the East, commissions paid on rejected cars, also commission on all consigned cars, office expenses, office furniture, telegraphing, stationery, and in fact every expense connected with the



entire working of the Exchange. We have on hand about \$5,000 collected as a guarantee fund, which will probably be refunded to the various associations. We will have at the end of the season from \$3,000 to \$10,000 that has been collected from the various associations, and held in reserve to meet expenses, that will be refunded at the close of the season. At the close of the season we hope to furnish the growers a detailed statement showing the various items of expense, etc., for the entire season.

In the meantime, if any of the growers wish to obtain any further information from the office, or look over any of the accounts or books, we will take pleasure in giving them every facility and furnishing them with all possible information. I would like to have all growers feel that they have the privilege of calling upon us for such information, and believe all employes in the office will take pleasure in explaining all of the workings of the Exchange and all details and accounts as fully as possible.

Yours, respectfully,

W. A. PERRY.

In San Francisco the orange market was very dull. This was due largely to the fact that the greater part of the California fruit found its way here in the dull season after the holidays and after the cold snap in the south. The ruling prices for the season are given herewith:

	Navels, per Box.	Seedlings, per Box.	Tangerines, per Box.
January 6.....	\$2 25@2 50	\$1 00@1 50	\$0 75@1 00
January 13.....	2 02@1 75	1 15@1 25	75@1 00
January 20.....	1 25@1 90	75@1 25	65@1 00
January 27.....	1 15@2 00	75@1 15	65@ 90
February 3.....	1 25@2 00	75@1 25	65@1 00
February 10.....	1 25@2 00	75@1 25	65@ 90
February 17.....	1 00@2 00	75@1 00	65@ 90
February 24.....	1 00@1 85	75@1 00	65@ 90
March 3.....	1 00@1 75	50@1 25	50@ 75
March 10.....	1 50@2 00	75@1 00	50@ 75
March 17.....	1 00@2 00	75@1 25	40@ 50
March 24.....	1 25@2 25	1 00@1 25	40@ 50
March 31.....	1 50@2 35	1 10@1 75	-----
April 7.....	1 50@2 35	1 00@1 75	-----
April 14.....	1 35@2 50	1 00@1 50	-----
April 21.....	1 35@3 00	1 00@1 50	-----
April 28.....	1 50@3 50	1 00@2 00	-----
May 5.....	1 50@3 25	1 00@2 00	-----
May 12.....	1 50@2 50	1 00@1 50	-----
May 19.....	1 50@2 50	1 00@1 50	-----
May 26.....	1 50@2 50	1 00@1 50	-----
June 2.....	1 50@2 50	1 00@1 50	-----
June 9.....	1 25@2 50	75@1 25	-----
June 16.....	1 25@2 50	75@1 25	-----
June 23.....	1 25@1 75	75@1 25	1 25@1 75
June 30.....	1 25@1 75	75@1 25	1 25@1 75
July 7.....	1 25@1 75	75@1 25	1 25@1 75
July 14.....	-----	-----	-----

#### CHERRIES.

The cherry season opened with rare promise; the trees were heavily loaded with bloom, and the fruit set well; but the extraordinarily heavy rains which fell during May and in the early part of June did a great amount of damage in the cherry districts, although the output of fruit was still large. The rains which came during the picking season hindered the gathering of the crop, and much of the fruit had to be left until it was overripe and unfit for market. The keeping qualities of the fruit were also impaired by the rain, and much that found its way to market was either spoiled or in a very inferior condition. As a result, prices were very low, dropping to 2 cents, and many growers realized but little more than the cost of picking their fruit. Some of the later

fruit came through in better condition, and prices advanced to 4 cents for Royal Anns and 2½ cents for mixed black and Royal Anns.

While the value of the crop was very largely impaired by the inopportune rains, the yield was large and the amount of money brought into the State was very considerable. Large shipments were made to Northern and Eastern points, principal among which were, north: Seattle, Tacoma, and Portland; east: Ogden, Salt Lake, Denver, Minneapolis, and St. Louis; south: Los Angeles, San Diego, El Paso, Prescott, and New Orleans. Eastern sales of good shipping varieties were satisfactory, those which sold at low figures being in bad condition. Many lots sold at from \$1 75 to \$2 10. At \$2 per box in Chicago the grower would net 14 cents per pound for his fruit on the tree, allowing for picking 1 cent per pound, box 5 cents, packing 5 cents, freight and loading 26 cents, and commission 7 per cent. At \$1 per box the grower would realize about 4.7 cents per pound. The average price of cherries in the Chicago market this season, or of those which arrived in good condition, was \$1 30 per box of ten pounds, which would net the grower 7.4 cents per pound for his fruit on the tree. At these figures cherry growing is profitable, even in view of the fact that the cherry tree is slow in coming into bearing. Of course, inferior watery varieties, as the Cleveland, Governor Wood, Rockport, etc., do not pay, as they cannot reach the market in good condition. In commenting upon this subject, the Fruit Exchange, in their bulletin, recommend as follows:

It is foolish to continue to cultivate trees with no hope of profit, and the obvious course to pursue is to graft over every tree of the non-profitable varieties into Black Tartarian, Royal Ann, Black Republican, or other good carrying cherries of those types. With this done, let the grower learn the precise stage in which to pick them, pack carefully in well-seasoned and well-ventilated boxes, arrange for prompt and careful delivery to the cool car, under contract that it shall not be packed too full to permit free circulation, and put his trust in Providence. One year with another he will do well, and the world will look bright to him. Those who persist in raising unsuitable fruit, or sending good fruit poorly packed, or otherwise likely to arrive in bad order, will have no business to abuse "over-production," the "infernal auction system," the "thieving middleman," or anybody else outside their own family. We may some time deliver East more sound, ripe cherries of the best varieties than can be sold at a profit under present conditions, but we have never yet done so.

The demand for canning varieties was not so large as usual this season, the continued stringency in the money market and the unsettled condition of business causing the packers to move cautiously. The canners, however, consumed a very considerable portion of the crop in the latter part of the season.

San Leandro, Alameda County, is in the heart of the cherry district, some 500 acres in this vicinity being wholly devoted to the culture of this fruit. The trees run about 103 to the acre, and average 100 pounds of cherries to the tree. This would give a crop of 5,000,000 pounds at San Leandro, which was a very heavy sufferer from the heavy rains in the late spring.

Santa Clara County, the next important cherry section, suffered in a less degree. The fruit here was not in so advanced a state as in Alameda County, and therefore suffered less damage from the rains. Up to June 11th there had been shipped from San José 2,619,405 pounds of cherries, the shipments for the week ending with the above date being the heaviest recorded, amounting to 1,148,065 pounds, or forty-seven carloads.

In Sonoma County the early crop was almost totally destroyed, few if any shipments being made. The later varieties, however, escaped damage, and heavy shipments from Santa Rosa took place later in the season.

While the cherry growers and packers suffered from the heavy rainfall at this season, the downpour was a most providential one for the producers of other fruits and for the State in general. A drought of fifty days' duration, the longest in the annals of the State during the rainy season, had been broken. A most disastrous dry season had been anticipated, and all lines of business were suffering. Stock was offered almost at the buyers' price; hay was rapidly advancing in price beyond the reach of consumers, and even fruit growers, to whom periodical rains are not a necessity, began to be dubious about the result. In the latter part of April the rain came. It was copious from the Oregon line southward to Monterey and San Joaquin Counties, but the first rains were very light south of these points. However, sufficient rain fell in the mountains to insure water for irrigation, so it may be said that the fruit interests suffered very much less than any others from the long dry spell of last winter. The greater loss experienced was, as explained before, suffered by our cherry packers, who were caught by the heavy storms fairly in the midst of their busy season, and interfering seriously with the pack. Much, even of the fruit that was packed under the supposition that it was uninjured, was damaged, reached the market in very poor condition, and sold at low prices. The later varieties, which escaped the damaging rains, however, carried in excellent shape and netted good returns.

#### DAMAGE FROM THE STRIKE.

The prospects for a large demand and good prices for California fresh fruit were never better than at the opening of the present season. A very severe frost swept over the fruit sections of the Eastern States when the trees were in bloom. In many places the crop was totally destroyed, and in most localities very severely injured. In Georgia the freeze was very severe and the fruit crop was entirely destroyed. In Delaware at least 75 per cent of the peach crop was ruined, while the remaining 25 per cent was damaged. Not so much damage was inflicted upon New Jersey, which, nevertheless, suffered to some extent. Southern Illinois, Michigan, and Kentucky were also heavy sufferers. The apple crop was also badly damaged, and it was reported that there would be a shortage of 50 per cent in the entire fruit crop of the Eastern States affected by the freeze.

In view of these facts the California growers naturally expected a heavy demand and good prices for their fruits, but the late rains damaged the cherry crop, and when the apricots and early peaches were ready for shipment, the great strike, which tied up all the transcontinental lines, had been inaugurated, and our growers found themselves with large crops of fine fruit on hand and no means of reaching the market. As a result, the losses to our orchardists were very heavy, and, while it is not possible to obtain an accurate account of the amount, conservative estimates are to the effect that a million of dollars would not make the fruit growers of California whole from the effects of the strike. Reports received from the principal fruit centers while the strike was in progress were as follows:

SACRAMENTO.—Hale's Early peaches are rotting on the trees, and the loss from that source alone will run into thousands of dollars. Early plums, including Tragedy and other varieties, are already too ripe for shipment, and the probabilities now are that the crop will be a total loss. One half the Bartlett pear crop is now ripe enough for shipment, and in a few days it will not bear transportation. Growers say that if the strike



lasts another week the crop will be a total loss. Most of the fruit men are drying their apricots, and the loss in that fruit will not be large. The fruit men in this county have nothing to depend upon except the local market and the local cannery. The latter only takes fruit from day to day at its own prices, and as fruit is abundant it is compelled to reject the loads of many farmers. So far the cannery has gained rather than lost by the situation.

**PLACER COUNTY.**—The loss to the growers of Placer County up to the present time is about \$50,000. The estimated loss for each day at present is from 12 to 20 carloads, or from \$5,000 to \$10,000. The crop now ripening consists of all varieties of plums and the peach known as the Early Crawford, which is one of the staple varieties and very valuable to the producers. Bartlett pears are also about ready for shipment, and all of these varieties mentioned will be a total loss unless harvested in a very few days.

**VACAVILLE DISTRICT.**—The stoppage of fruit shipments from this point has had a very disastrous effect upon the fruit growers, and many small ones will be nearly ruined. Quite a number have nearly all the fruit they raised this year now in the blockades, and there is no prospect of realizing a cent. Several of the prominent growers and shippers say that the loss to Vacaville township now stands between \$50,000 and \$60,000. Should the strike continue two weeks more the amount will be quadrupled, as the town ships from thirty to seventy cars of fruit each week. Every fruit grower in Vacaville township has now turned his attention to drying. Apricots are easily disposed of in this manner; but here another difficulty has presented itself: Owing to the heavy demand for drying-trays, lumber suitable for that purpose is exhausted, and more cannot be had at any price. Peaches, prunes, and plums are also being dried, in hopes of getting something for them; but other fruit, grapes and pears, for which there is no demand in the dried state, are a total loss, as Vacaville township has no cannery.

**FRESNO.**—Fruit in boxes is rotting in warehouses, and more is rotting in orchards. Perhaps the loss to date is \$50,000. Buyers will no longer engage fruit, sales are being canceled, and, in fact, the condition simply means ruin to one of the most prosperous industries in the San Joaquin Valley if the blockade is not soon raised.

**SAN JOSÉ.**—The damage to orchardists on account of the strike amounts to several thousand dollars, principally on account of cherries in cars bound for the East, which are unable to get to market on account of the blockade. The canneries are not packing cherries this year, and consequently the growers depend entirely upon the Eastern market. Before the blockade about half of the crop had matured and had been disposed of, but the remainder is almost a total loss. The loss on other varieties of fruit will not be great, as the bulk of the crop is dried.

**LOS ANGELES.**—There have been no complaints as yet on the part of fruit growers in this vicinity on account of the railroad tie-up, unless in a few individual instances. There is little fresh fruit shipped at this time, and most of that can find a ready market in Los Angeles.

The complete tying up of all trains, and the uncertainty of moving freight, stopped all fruit traffic from the latter part of June to the end of July. It was not until the last few days of July that regular movements of fruit trains were resumed, and in the meantime a very large and important part of the fruit season had passed. The early fruit sections were especially the sufferers by the blockade, as the market for early fruits was practically closed before the blockade was raised. Sections devoted to later fruits, while suffering somewhat from the tie-up, did not feel it so severely.

In regard to the condition of the present season's crop, the demand, prices, and result of the tie-up, E. T. Earl, President of the Earl Fruit Company, writes:

SACRAMENTO, CAL., August 3, 1894.

B. M. LELONG, Esq., Secretary State Board of Horticulture, San Francisco, Cal.:

DEAR SIR: Replying to yours of the 2d inst., the deciduous fruit crop in California for the present season is one of the largest ever grown. Nearly all varieties are a full crop, and some are exceedingly heavy. We have heard of no real failure in any district.

The deciduous fruit crop in the Eastern States is light, but the hard times and scarcity of money have had a very depressing effect on California green fruits; at the same time fair prices have been realized.

The railroad strike seriously interfered with the shipping of California fruit for about three weeks in July, and at a time when heavy shipments should have been made. A great deal of fruit became too ripe, and very little was realized for it, as it could not be shipped East, and the local markets would not take it. Fruit suitable for drying purposes was dried, and if decent prices are realized for dried fruits, such varieties will not prove a total loss.

Since the strike ended heavy shipments of fruit have been made to Eastern markets. Over 500 cars went East during the week ending July 28th. In consequence of these

heavy shipments we anticipate low prices will rule for some time, as they will certainly overstock Eastern markets.

The total shipments from California to August 1st are about the same as to same date last season, notwithstanding several weeks of the present season were lost. If reasonable prices are realized in Eastern markets, we anticipate that shipments this season will be several thousand cars in excess of last season. It all depends upon the Eastern markets, however.

Yours, very truly,

E. T. EARL,  
President.

#### APRICOTS.

Apricots have yielded phenomenally well this season. In the early spring a late frost nipped some of the orchards on the lower and more exposed lands, and it was at first feared that much damage had been done, but subsequently it developed that little injury had been done even in those exposed locations, while on the higher lands the trees were overburdened with fruit, and vigorous thinning was a necessity.

Prices generally were satisfactory. In the southern counties fruit was sold by the acre on the trees, and prices ranged from \$40 to \$400 per acre. Apricots delivered at the drying-grounds brought \$30 per ton. In Sutter County \$27 50 was offered for apricots for drying.

While the output has been very large, the size of the fruit has not reached the usual average, and the first grade pack known as No. 1 or fancy has been a smaller proportion of the whole than in previous seasons.

The output of dried apricots this season will be very largely in excess of that of any previous year; it is now estimated at from 8,000 to 10,000 tons. The largest previous record is that of 1891, when the output of dried apricots was something in excess of 6,000 tons. The increase in dried apricots this year is largely due to the strike which tied up the railroads in the midst of the shipping season, shut off the Eastern market, and compelled the growers to make other disposition of their crops. The strike also demoralized the market for early dried fruit, and 118 carloads of this season's crop, which was ready for shipment at 9 to 10 cents per pound, were left in the growers' hand until the later fruit increased the supply, and the price dropped to 6½ and 7. Some few offers at these figures were accepted, but as California growers have practically a monopoly of this fruit, it is improbable that much will be sold at these figures. At a meeting of representatives of fruit exchanges throughout the State, held at San José on August 4th, a resolution was passed fixing the price of dried apricots at 8, 10, and 12 cents per pound for the three higher grades; and as the great bulk of the crop was represented, it is probable that only small lots in the hands of individuals who are forced to sell will be disposed of at the lower prices quoted.

#### PRUNES.

Prunes have fallen far below the average, and while the new orchards which have come into bearing will add very largely to the bulk of the total output, the yield falls about 30 per cent below the average. There were limited districts where a full crop was reported, but in the principal prune sections, from which the bulk of the crop is derived, the fruit set very light, and not over one fourth to one third of the usual annual yield was reported. The favorable growing weather and the thinning out of the fruit have somewhat increased the size of that remaining, but

this increase in size was not sufficient to make up the deficiency in yield. The many new orchards, however, which added their yield to the total bulk, very largely made up for the deficiency, and while the average yield is far below, the total output of the State will approach that of former years. The total product of prunes in the State will probably foot up nearly 40,000,000 pounds.

The average consumption of prunes in the United States is now 70,000,000 pounds, of which California supplies two thirds, and in an ordinary year with a full average crop our local product would entirely force the foreign article from the market.

This brings us face to face with the important question of a future market for our prune crop. California this season, with but a partial crop, has produced two thirds the average annual consumption of the United States. Oregon, Idaho, and Arizona are producing prunes to some extent. In our own State there are large areas of young orchards yet to come into bearing, and of those already bearing many have not yet reached their full capacity. When these all contribute their full quota to the annual output, California's yield will be doubled. In view of these facts some measures should be taken with a view to widening our market for this fruit and encouraging its more general use in Eastern households.

Prices offered by dealers have been from  $4\frac{1}{2}$  to 5 cents for the new crop, which will not be in until September. The fruit exchanges of the State, however, have fixed the minimum at 6 cents, at which they have determined to hold the fruit under their control.

#### PEARS.

Pears have yielded an unusually heavy crop, Bartlett's ranging at least 10 per cent above the average, and all other varieties being full. In the early season reports from many pear sections were to the effect that fruit was dropping badly, and it was feared that a shortage would prevail in some sections. This fear, however, was not realized, as the dropping stopped before the fruit had been more than sufficiently thinned to insure its quality. What had therefore appeared an evil proved to be a benefit to the grower, and an unusually large crop of fine fruit was the result.

The market price of the pear crop was not so seriously affected by the labor disturbances of the present season as was that of the earlier fruits. When pears came upon the market the strike had nearly run its course, and while the earlier pickings were somewhat affected by it, the greater part of the crop was not interfered with and found its usual Eastern outlet at fair prices.

#### PEACHES.

From all parts of the State reports of the peach crop are to the effect that it is very heavy, and in active demand at good prices. As was the case with almost all other fruit, the strike interfered very seriously with the marketing of the earlier varieties, and growers who did not have the usual Eastern outlet were compelled to dry. The later varieties found a good market, the Eastern crop being very light, owing to the severe frost in the Eastern peach sections. The canning varieties, which are now being gathered, are turning out as well as the others, and altogether



the present may be said to be the most prosperous fruit season in California.

Prices have not been as good as could have been wished. The strike shut off the usual market for our early fruit, and very much of it sought San Francisco, the only outlet left to it, and prices for awhile were slaughtered. With the resumption of Eastern business, however, they recovered, and the general average for the season was fair. The June quotations for peaches in the San Francisco market ranged from 40 to 75 cents per twenty-pound box; by the end of the month, however, these prices had fallen 25 to 50 per cent. In the middle of July, when the strike had forced a glut in the market, prices dropped to 20 to 35 cents per box, which was the lowest price touched. Upon the resumption of traffic, and the opening of the canneries and driers, prices again advanced.

While the financial depression in the East has very materially curtailed the demand for our fruits at former prices, and the California orchardist has not received as much for his products as in some past years, the very large output of fruit in the State will bring immense sums of money to us. In this connection reports from Sonoma County state:

The fruit crop in Sonoma County is enormous, far surpassing that of any previous year, and the quality has never been excelled. Peaches and pears are marketed by tons instead of by pounds as formerly, and even small orchardists are employing a large number of hands picking and caring for the fruit. They are refusing \$15 a ton for peaches, preferring to dry or can. Pears are quoted at \$12 a ton. Prunes are selling at \$20 a ton to driers. Many new driers have been erected this year, and all the fruit-preserving establishments are employing more help than ever before. Hop growers report that the hop crop in the county is up to the average. A new industry, in the shape of a sugar-beet factory, is to be established at Sebastopol. Farmers intend to engage largely in the cultivation of beets.

Similar reports are made from all the counties of the State. A prominent packer who has made investigations gives the following as his estimate of fruit yield and prices for the present season, which may be accepted as nearly accurate as an estimate can be:

The yield of apricots will be 60,000 tons, of which 5,000 tons will be canned, and the rest dried or shipped as fresh fruit. This crop will make 700 to 800 carloads, and ought to bring in a revenue of \$1,200,000. The price is placed at from \$20 to \$25 for the fresh fruit.

Of prunes, the whole crop, practically, is dried. There will be 50,000,000 pounds of the dried article, and it will be worth \$2,500,000 on the basis of 5 cents per pound.

Of peaches, there will be 75,000 tons, worth, at a conservative estimate, \$1,500,000.

Bartlett pears will yield 25,000 tons, and will be worth \$500,000.

Besides these fruits there are the plums, raisins, almonds and other nuts, oranges and lemons, bringing in larger or smaller amounts, but from the items already given, it can be seen that the aggregate value of the fruit products of California must be a very large one.

#### COÖPERATIVE MOVEMENTS.

The unsatisfactory prices and treatment which growers have received from commission men and jobbers have encouraged the growth of co-operation in the marketing of orchard products. The success of the Southern California Fruit Exchanges has very largely influenced this, and what has been accomplished in the handling of citrus fruit by this association has been equaled in the manipulation of cured fruits by the Campbell Fruit Union of Santa Clara County. Some interesting facts and figures concerning this association are furnished by the California Fruit Exchange, and taken direct from the books of the company.

The association began business with the purchase of a drying-ground and plant located at Campbell Station, on the S. P. C. R. R., to which they added some acres of land by subsequent purchase. The books show the following facts:

INVESTMENTS.	
17 acres land .....	\$12,725 00
10 horse-power steam engine .....	
18 horse-power steam boiler .....	
2 canning-house prune dippers .....	
Scales and trucks .....	
Building, 80x150, one-story .....	320 00
2 Jones largest fruit graders @ \$160 .....	
1 Jones No. 8 fruit grader .....	
1 Hamilton prune grader .....	
1,500 orchard boxes @ 15 cents .....	
24,000 3x8 drying-trays @ 35 cents .....	
24,000 3x8 drying-trays @ 35 cents .....	8,400 00
Total .....	\$21,945 00

These are not exact figures, as many of the trays were turned in by stockholders at various prices according to their condition; but they represent the cost of the material, if all new.

In exact figures the actual investment is as follows: Paid-up stock, \$18,400; indebtedness on land, \$4,000.

The plant is not complete, however, as the building will only store, in addition to the room required for machinery and working, about 150 tons of fruit, so that unless they sell very promptly they choke up. The association has voted to build a fireproof warehouse to hold any surplus which they may wish to store. They propose also some other betterments, and for the next full crop will have to buy several more acres of land. The naked land at that place is worth \$500 per acre. Most associations, of course, can purchase land at a much lower price than that, and require less capital accordingly.

#### ACREAGE ACCOMMODATED.

The acreage of drying fruits owned by the stockholders of the Union is as follows:

Full bearing, 1893 .....	700 acres.
Younger orchards .....	522 acres.
Total .....	1,222 acres.

It is to accommodate the fruit as the younger orchards come in that more land will be required, as well as additional grading machinery, trays, etc., the latter having been taxed rather more than its capacity in 1893, when, on some days, more than 100 tons of green prunes were delivered.

The paid-up stock and indebtedness amounts now to \$18 50 per acre, and it is expected that fully \$25 per acre will be required to furnish a complete plant and sufficient drying-ground. This money will be raised, when required, by sales of additional stock to present members only, as no new members can now be received. The stock can always be sold, however, as it pays regular 7 per cent dividends free of taxes. The naked land at their site is worth \$500 per acre. Had they been able to buy land for \$100 per acre, their present plant would now cost only \$13 per acre of the acreage accommodated.

With the above plant as it is, the association received, in 1893, 3,600 tons of fresh fruit, which made 1,043 tons when dried.

#### EXPENSE OF OPERATION.

The officers and Directors of the association have hitherto received no compensation, except such as might happen to be employed to do special work requiring full time, for which, of course, they were paid. At the last annual meeting, on account of the growth of the business requiring so much time from the Directors, a small annual fee was allowed to each. The President should, and probably does, receive some additional compensation. The other expenses are such as would necessarily be incurred in any private concern, except that 7 per cent interest on the paid-up stock is charged as an item of expense against the fruit handled. This, of course, goes back to the owners of the fruit, who are also the stockholders. No outside capital is admitted, but as some growers who were able to do so made it possible to start the enterprise, by taking more shares than their acreage required, their interests are equalized by the dividends on their extra stock.

#### METHODS.

The grower delivers his fruit to the drier in orchard boxes. It is at once placed on the graders, and when graded he obtains his receipt specifying the variety and weight of each grade. All fruit is graded by machinery, and there can be no complaint. From that time its identity is lost, all being dried together, sold by the association, and the proceeds distributed. No money—except a very small sum—is raised for working capital. Several thousand dollars are needed to pay pitters and other help at the beginning of the season, but that is repaid from the first sales of fruit, and it is considered cheaper

to borrow what is needed, for sixty or ninety days at current rates, than to pay 7 per cent on the amount as capital stock for the entire year. If fruit sells promptly, the proceeds are of course distributed. If it is preferred to hold for a time, and growers needed money, it is borrowed by the association on its general credit, and advances made, at the same interest that the association pays. The Directors determine when sales are to be made, but are of course influenced by the judgment of other stockholders, whom they meet daily. All growers receive precisely the same prices for the same grades of fruit, and this is the average price of all the sales of the year for fruit of the same grade. When sales are made through a commission house, the commission agent does not ordinarily handle the money, but the association ships to the purchaser, collects the money, and pays the commission man. Receipts are given for green tons, and settlement made on the same basis. A certain amount, believed to be sufficient, is charged against the fruit, to cover depreciation of plant, wear and tear, insurance, and some other expenses. For 1893, this charge was \$1 per green ton, which, in that year gave the association \$3,600, which leaves them, after paying other charges, a sum sufficient to put the plant in rather better condition than at the beginning of the season.

## RESULTS.

After paying all expenses of every kind, the association makes its final settlement. The amounts distributed, per green ton, for 1892 and 1893, were as follows. The numbers of the grades refer to size of fruit, No. 1 being the largest:

	1892.	1893.
		Average.
Apricots, No. 1.....	\$46 29	\$23 16
Apricots, No. 2.....	39 78	
Apricots, No. 3.....	39 68	
Apricots, No. 4.....	29 00	
Peaches—Crawford, Foster, etc.—No. 1.....	28 44	10 86
Peaches—Crawford, Foster, etc.—No. 2.....	27 98	
Peaches—Crawford, Foster, etc.—No. 3.....	31 68	
Peaches—Crawford, Foster, etc.—No. 4.....	24 00	
Muir peaches, Nos. 1-2.....	46 67	21 16
Muir peaches, Nos. 3-4.....	48 82	
Prunes (average).....	85 00	34 00

The low prices received for apricots and peaches in 1893 are attributed to the fact that exceptional financial conditions, rendering borrowing impossible, compelled a sale of these goods early in the season, before the southern growers had sold out. Fair prices are never expected in full crop years until goods in hands of unorganized growers have been cleaned up.

The prices received in 1892 indicate what may happen again in years where the crop is short and shrinkage light

## SHRINKAGES.

The following table of the experience of the Campbell Union for 1892 and 1893 is worthy of careful study by those contemplating the sale of their fresh fruit to driers:

	1892.	1893.
		Average.
Apricots, No. 1.....	5.10 to 1	5.54 to 1
Apricots, No. 2.....	5.30 to 1	
Apricots, No. 3.....	4.92 to 1	
Apricots, No. 4.....	5.32 to 1	
Crawford peaches, No. 1.....	5.78 to 1	6.97 to 1
Crawford peaches, No. 2.....	5.68 to 1	
Crawford peaches, No. 3.....	4.83 to 1	
Crawford peaches, No. 4.....	5.28 to 1	
Muir peaches, Nos. 1-2.....	3.75 to 1	4.71 to 1
Muir peaches, Nos. 3-4.....	3.50 to 1	
Salway peaches (average).....	4.03 to 1	5.45 to 1
Cling peaches (average).....	5.35 to 1	6.63 to 1

In the above tables the numbers of the grades of fruit refer to the sizes as they come from the graders, No. 1 being the largest.

It must be remembered that while the Campbell Union expects to invest in the end \$25 per acre for a complete, thoroughly equipped plant, with drying-ground costing \$500 per acre, they began on a much more modest scale. If they had been able to get land worth not more than \$100 per acre, their present plant would have cost \$13 per acre of orchard served instead of \$18 50.



## FRESH AND DRIED FRUIT PRICES COMPARED.

Many growers are at a loss to know, when offered prices for fresh fruit, what prices they must get for dried fruit to pay them equally well. The following table, compiled last year from the experience of the West Side Fruit Growers' Association in Santa Clara County, will be found a fair guide:

Fruit.	Pounds green to make one dry.		Cost of drying per dried pound.	Equivalent net prices per ctl. of dried, compared with prices per green ton, on basis of shrinkage of 1891.					Net average prices per ctl. realized for dried fruits, after paying all expenses.	
	1891.	1892.		\$30 00	\$35 00	\$40 00	\$45 00	\$50 00	1891.	1892.
Moorpark apricots..	5¼	5½	2 cents.	\$9 87½	\$11 18	\$12 50	\$13 81	\$15 12	\$7 25	\$15 00
Other apricots.....	6¼	5¾	2 cents.	11 37	12 94	14 50	16 06	17 62	6 50	13 13
Early peaches.....	5½	5¼	1½ cts.	9 75	11 12	12 50	13 87	15 25	5 50	11 00
Late peaches.....	5	4½	1½ cts.	9 00	10 25	11 50	12 75	14 00	{ None { dried.	Not sold.
French prunes.....	2.54	1.92	¾ cts.	4 56	5 19	5 83	6 46	7 10	\$5 30†	\$8 87½†

†The prices given for prunes are for the four sizes. The general average will vary a little either way in different years, as the prunes run large or small.

The above table was prepared for Santa Clara County, where, except for peaches, rates less than \$30 per ton for fresh fruit seldom need to be computed. For the benefit of less ambitious districts we add the equivalent prices at \$20 and \$25 per ton, viz.: At \$25 per ton—Moorpark apricots, \$8 56; other apricots, \$9 81; early peaches, \$8 37½; late peaches, \$7 75; French prunes, \$3 87½. At \$20 per ton—Moorpark apricots, \$7 25; other apricots, \$8 25; early peaches, \$7; late peaches, \$6 50; French prunes, \$3 25.

The meaning of this is that the buyer who pays the named prices per fresh ton must get the corresponding prices per dry pound *net* to get even, provided his shrinkage is the same, as well as his expense of drying and sacking. Interest at 8 per cent on plant and something for depreciation is reckoned in cost of drying. The grower who, with his family, does the work, and who reckons no interest on drying-ground or plant, and allows nothing for depreciation, would, upon the face of it, save most of the cost of drying.

In regard to shrinkages, growers must estimate for themselves, as they vary more or less. The greatest variation is among the different varieties of peaches. The shrinkages of the East Side Fruit Growers' Union of Santa Clara County for 1893 were as follows:

Apricots (all varieties).....	5.56 to 1
Peaches (all varieties).....	6.04 to 1
Pears (all varieties).....	7.11 to 1
Nectarines (all varieties).....	8.00 to 1
French prunes.....	2.66 to 1
Silver prunes.....	3.18 to 1
German prunes.....	2.86 to 1
Egg plums.....	4.98 to 1

## MOVEMENTS OF FRUITS.

The following table gives the total fruit imports into the United States for the year ending June, 1894:

Kind.	Quantity— lbs.	Value.
<i>Dutiable.</i>		
Figs .....	7,985,959	\$392,040
Lemons .....		4,285,278
Oranges .....		1,127,005
Plums and prunes .....	9,908,122	416,342
Raisins .....	13,751,050	554,090
Preserved fruits .....		526,551
All other fruits .....		1,159,545
Almonds .....	7,436,784	769,453
All other nuts .....		631,738
Total .....		\$9,862,062
<i>Free.</i>		
Bananas .....		\$5,121,364
Cocoanuts .....		786,777
Currants .....	52,664,843	774,802
Dates .....	12,408,172	387,585
All other .....		1,820,074
Total .....		\$8,890,102
Grand total imports .....		\$18,752,164

The total importations for the same period last year were \$23,687,422, showing a falling off in the value of fruit imports of \$4,935,258. How much of this was due to the depression of business and financial stringency and how much to California's increased output, which is pressing foreign imports close, it is of course impossible to state. The figures given, however, indicate that in several departments California does not yet occupy the entire home market, nor so much of it as she should. While in fancy brands of raisins and prunes we are hardly prepared to contest the market with foreign packers, inasmuch as our growers have not turned their attention to these brands, yet the importation of 9,908,122 pounds of plums and prunes and of 13,751,050 pounds of raisins, at a cost of \$970,432, indicates that there is still a large domestic field for these products.

The importation of Zante currants for the past year was 52,664,843 pounds, appraised at \$774,802. This fruit has as yet been produced to but a limited extent in California, but enough has been done to prove our capabilities in this direction, and it would appear that here is an opening in our domestic market for another California industry that we should fill.

A very considerable export trade in fruit is carried on by sea between California and the Islands, Central and South America, China, and Japan. A large proportion of this trade consists of canned fruit, which finds its way to all points in the western hemisphere. Apples form another important article of fruit export, and are shipped largely to Central America and Australia. The following tables give the exports and imports of fruit from the port of San Francisco for the fruit season, by months, commencing with November, 1893:

*Exports of Fruit by Sea from the Port of San Francisco, for the Nine Months ending July 30, 1894.*

Kind.	Value.	
1893—November—Apples, fresh (2,265 bbls.) .....	\$5,264 00	
Canned fruit .....	22,201 00	
All other fruit .....	3,982 00	
Nuts .....	1,309 00	\$32,756 00
December—Apples, fresh (2,084 bbls.) .....	\$4,099 00	
Canned fruit .....	29,139 00	
All other fruit .....	1,043 00	
Nuts .....	1,065 00	35,346 00
1894—January—Apples, fresh (766 bbls.) .....	\$1,623 00	
Canned fruit .....	13,148 00	
All other fruit .....	1,787 00	
Nuts .....	700 00	17,258 00
February—Apples, fresh (410 bbls.) .....	\$398 00	
Canned fruit .....	30,725 00	
All other fruit .....	1,146 00	
Nuts .....	742 00	33,511 00
March—Apples, dried (5,000 lbs.) .....	\$475 00	
Apples, fresh (228 bbls.) .....	678 00	
Canned fruit .....	16,381 00	
All other fruit .....	3,019 00	
Nuts .....	468 00	21,021 00
April—Apples, fresh (130 bbls.) .....	\$358 00	
Canned fruit .....	17,492 00	
All other fruit .....	2,469 00	
Nuts .....	499 00	20,181 00
May—Apples, dried (10,000 lbs.) .....	\$1,225 00	
Apples, fresh (18 bbls.) .....	85 00	
Canned fruit .....	18,089 00	
All other fruit .....	4,082 00	
Nuts .....	403 00	23,884 00
June—Apples, fresh (47 bbls.) .....	\$88 00	
Canned fruit .....	11,489 00	
All other fruit .....	2,833 00	
Nuts .....	280 00	14,690 00
July—Apples, fresh .....	\$1,186 00	
Canned fruit .....	14,185 00	
All other fruit .....	5,316 00	
Nuts .....	658 00	21,345 00
Total .....		\$220,629 00

*Imports of Dutiable Fruit by Sea at the Port of San Francisco for the Nine Months ending July 30, 1894.*

Kind.	Value.	
1893—November—Oranges .....	\$1,479 00	
Preserved fruit .....	5,256 00	
All other fruit .....	1,986 00	
Almonds .....	97 00	
All other nuts .....	334 00	9,152 00
December—Oranges .....	\$3,159 00	
Preserved fruit .....	1,081 00	
All other fruit .....	1,036 00	
Almonds .....	938 00	
All other nuts .....	2,142 00	8,356 00
1894—January—Figs .....	\$7 00	
Oranges .....	2,353 00	
Preserved fruit .....	1,490 00	
All other fruit .....	1,758 00	
Almonds .....	212 00	
All other nuts .....	243 00	6,063 00



1894—February—Oranges .....	\$234 00	
Plums and prunes .....	345 00	
Preserved fruit .....	1,962 00	
All other fruits .....	1,914 00	
Almonds .....	23 00	
All other nuts .....	63 00	
		\$4,541 00
March—Oranges .....	\$35 00	
Preserved fruits .....	888 00	
All other fruits .....	1,737 00	
Almonds .....	301 00	
All other nuts .....	97 00	
		3,058 00
April—Oranges .....	\$39 00	
Preserved fruits .....	1,694 00	
All other fruits .....	2,102 00	
Almonds .....	15 00	
All other nuts .....	224 00	
		4,074 00
May—Oranges .....	\$5 00	
Preserved fruits .....	1,889 00	
All other fruits .....	2,378 00	
Almonds .....	89 00	
All other nuts .....	193 00	
		4,554 00
June—Oranges .....	\$6 00	
Preserved fruits .....	873 00	
All other fruits .....	2,336 00	
Almonds .....	87 00	
All other nuts .....	36 00	
		3,338 00
July—Lemons .....	\$55 00	
Preserved fruits .....	1,004 00	
All other fruits .....	1,779 00	
Almonds .....	13 00	
All other nuts .....	58 00	
		2,909 00
Total .....		\$46,045 00

The following table shows the movements of fruit by months over the lines of the Southern Pacific Railroad, from the close of the last fruit season. This does not include shipments from Southern California points, from which information was not obtainable:

*Number of Tons of Various Commodities Forwarded East from California Points Named.*

Month.	From—	Green Fruit—De- ciduous.	Dried Fruit.	Raisins.	Nuts.	Canned Fruit and Vegetables	Green Fruit— Citrus.
November, 1893	San Francisco ..	52	606	113	76	1,818	-----
	Oakland .....	190	225	13	-----	145	-----
	San José .....	1,611	4,218	1	1	803	-----
	Stockton .....	416	686	10,088	1	53	-----
	Sacramento .....	1,164	1,517	313	5	458	-----
	Marysville .....	169	270	106	-----	172	-----
	Tons .....	3,542	7,522	10,634	83	3,449	-----
December, 1893	San Francisco ..	67	594	62	16	615	15
	Oakland .....	30	29	-----	-----	13	-----
	San José .....	736	1,372	6	-----	358	-----
	Stockton .....	221	221	2,629	-----	97	-----
	Sacramento .....	263	564	494	-----	357	-----
	Marysville .....	135	263	93	-----	42	-----
	Tons .....	1,231	3,043	3,284	16	1,482	15

Month.	From—	Green Fruit—De- ciduous.	Dried Fruit.	Raisins.	Nuts.	Canned Fruit and Vegetables	Green Fruit— Citrus.
January, 1894.	San Francisco ..	4	405	122	24	694	-----
	Oakland ..	-----	-----	-----	-----	74	-----
	San José ..	427	757	2	-----	121	-----
	Stockton ..	-----	188	1,787	-----	-----	-----
	Sacramento ..	80	332	190	-----	247	-----
	Marysville ..	76	64	68	-----	22	-----
Tons .....		587	1,746	2,169	24	1,158	-----
February, 1894.	San Francisco ..	19	446	134	22	1,000	-----
	Oakland ..	13	36	-----	-----	-----	-----
	San José ..	246	588	3	-----	193	-----
	Stockton ..	-----	220	1,849	-----	65	-----
	Sacramento ..	-----	431	198	-----	127	-----
	Marysville ..	106	128	14	-----	149	-----
Tons .....		384	1,849	2,198	22	1,534	-----
March, 1894.	San Francisco ..	1	592	22	5	1,363	-----
	Oakland ..	-----	27	12	-----	10	-----
	San José ..	83	1,090	-----	-----	586	-----
	Stockton ..	-----	234	1,153	-----	30	-----
	Sacramento ..	-----	367	48	2	429	-----
	Marysville ..	-----	96	14	3	180	-----
Tons .....		84	2,406	1,249	10	2,598	-----
April, 1894.	San Francisco ..	-----	631	112	4	2,061	1
	Oakland ..	-----	27	-----	-----	129	-----
	San José ..	13	1,541	-----	-----	595	-----
	Stockton ..	-----	216	1,788	-----	13	-----
	Sacramento ..	-----	206	119	-----	865	12
	Marysville ..	-----	48	11	-----	99	-----
Tons .....		13	2,669	2,030	4	3,762	13
May, 1894.	San Francisco ..	-----	352	79	9	754	-----
	Oakland ..	-----	-----	-----	-----	32	-----
	San José ..	61	227	-----	-----	303	-----
	Stockton ..	-----	106	590	-----	76	-----
	Sacramento ..	814	38	117	-----	363	-----
	Marysville ..	83	51	-----	-----	-----	-----
Tons .....		958	774	786	9	1,528	-----
June, 1894.	San Francisco ..	21	112	9	3	665	-----
	Oakland ..	620	-----	-----	-----	-----	-----
	San José ..	1,727	40	-----	-----	293	2
	Stockton ..	188	4	435	-----	129	-----
	Sacramento ..	6,238	13	-----	-----	136	-----
	Marysville ..	816	-----	-----	-----	-----	-----
Tons .....		9,610	169	444	3	1,223	2
July, 1894.	San Francisco ..	11	90	6	1	1,146	-----
	Oakland ..	234	-----	-----	-----	58	-----
	San José ..	297	12	-----	-----	138	-----
	Stockton ..	1,042	272	218	-----	-----	-----
	Sacramento ..	11,837	379	-----	-----	85	-----
	Marysville ..	829	158	1	-----	182	-----
Tons .....		14,250	911	225	1	1,609	-----

## CALIFORNIA FRUIT IN ENGLAND.

The shipment of fresh deciduous fruit direct to London, which was tried as an experiment two years since, and suspended in 1893, has been resumed this season by the California Fruit Transportation Company, who made their first shipment on August 5th. The train consisted of eleven refrigerator cars of choice, selected fruits, shipped by J. Z. Anderson, A. T. Hatch, F. H. Buck, Pinkham & McKevitt, C. W. Reed, and the Florin Fruit Growers' Association, from Suisun, Vacaville, Florin, and Gridley. The fruit was consigned direct to London, England, to W. N. White & Co., via the Union Pacific, C. & N. W., and Erie Dispatch to New York. At New York the fruit was transferred to the fast steamship Paris, of the American line.

The train reached New York in six and one half days, and the fruit was in London six days later. The cost of the freight is about \$750 per car, approximating 20,000 pounds to the car. This shipment was followed during the season by weekly specials of ten carloads each. The agent of the California Transportation Company said, speaking of this shipment:

The shipment of to-day should be sufficient inducement to shippers to take advantage of the chance of getting their fruit into the English markets. Recent advices would indicate that the outlook is promising for regular shipments, which will be distributed all over the United Kingdom. The company has demonstrated the physical part of the venture by the delivery of fruit in London in perfect order, and shippers should encourage their energetic efforts to promote California's interests by opening up this service, as with proper distribution we should handle a thousand carloads of California's luscious fruit during the season at remunerative prices, by relieving the domestic markets when over-supplied.

The fruit shipped consisted principally of Bartlett pears, Early Crawford peaches, and assorted varieties of plums and apricots.

In a review of the experiment made two years since, George H. Appel, Sacramento agent for the California Fruit Transportation Company, gives the following as the result of that year's work:

You will recall our missionary venture in 1892 of exporting California deciduous fruits to the United Kingdom. We of course met with opposition at this end, and also the same thing at the other end—the former on account of doubt of our ability to successfully transport the fruit, the latter with their doubts on the lasting quality of the fruit after coming out of the refrigerators. We demonstrated the physical part of it, and also convinced the British people that with our system of refrigeration the fruit would stand up, and our records show that we forwarded forty-nine cars of fruit to London and Liverpool during the season of 1892, where it was distributed throughout the United Kingdom.

The first twenty-five cars of fruit sold to great advantage, but owing to the heavy charges of \$1,350 per car, besides the commission and other minor charges, left but little for the shipper.

In order to encourage the shipper, the California Fruit Transportation Company made guarantee to a number of shippers of the same net results that could be gotten in New York, and at the same time sold in England, so that it resulted to the benefit of the grower. The last twenty-five cars landed during the excitement of the cholera scare, which retarded the sales, and the fruit did not sell for sufficient in all cases to meet the heavy expense. This, of course, proved a loss to the California Fruit Transportation Company. However, its officials, alive to the situation, being heavily interested in a large equipment of cars, which we have found necessary to furnish to supply the demands, in connection with our desire to promote the interests of California fruit growers, and, in a measure, solve the problem of the so-called over-production of California fruits, we wished to demonstrate our desire to open this source.

Through the efforts of our officials we have secured a rate of \$750 per car, which includes all expense, delivered in London. We have arranged with the American line of steamers, in which we will have our refrigerators, in the fast-sailing steamers New York, Paris, Berlin, and Chester, making weekly trips from New York. Our intention is to load out five cars weekly to make fast time to New York, which will be transferred to refrigerators on these steamers, making close connection, and with everything being



equal, should make about thirteen days to London—possibly may run a day or two longer should the steamers encounter stormy weather, etc.

The fruit will be sold in London for 5 per cent commission, and sales will be made direct to the shippers. This company has no connection whatever with the handling of the fruit, merely furnishing the transportation. However, we would be glad at any time to assist shippers in any way in this connection, and expect to have a regular report from different receivers in London and Liverpool and other cities in the kingdom, which we will be pleased to furnish you from time to time.

Our latest reports would indicate that heavy frosts have seriously damaged the small fruits in England, and drought has caused the pears to drop in France, and the plum crop in Germany is not so heavy as usual, so that shipments of choice peaches, plums, and pears will surely result advantageously to the shippers.

We found last season that California fruit would compete successfully with other fruit; in fact, we found that we could deliver California fruit in London oftentimes in better condition than the French William (Bartlett's) from France, just across the channel.

Our Vice-President, E. R. Hutchins, personally superintended the sale and handling of this fruit in 1892. He has just returned to Chicago, after consummating arrangements here with the railroad companies, and he has stated it was no unusual sight to see fruit peddlers with small carts, with signs reading, "California fruits," which sold readily at good prices. The middle class of people in England do not eat very much fruit, on account of the expense of that fruit grown in hot-houses, so that we think with the rates we have secured, that this fruit can be placed within easy reach of the masses, and see no reason why a great deal of California fruit cannot be sold, thereby relieving the domestic markets in a time of over-supply, resulting to the benefit of the California growers.

Until such time as we can evolve a better system of shipment of our fruits to England, including cheaper and better transportation, which may be effected by the abolition of heavy refrigerating cars, with their enormous dead weight and expensive icing, the English market can be little else than a last resort into which we may be compelled to send our surplus fruit when our home market cannot consume it. The experiments of 1892 and the experiments of the present season have very largely proved this. That it may some day become a profitable market is very probable, but it will be when we can deliver our fruits in better shape and at lower cost than we are now able to do. Reports which have been received concerning the shipments made this season are flattering as to the reception of our fruit by the English. It has won its way to their regard and there is a demand for more, and when we can lay it down at smaller cost for transportation, and with a smaller percentage of loss, there can be no question but that the English market will be a profitable field to work.

#### MARKETS FOR FUTURE CROPS.

In considering this question of markets for our future fruit crops, H. Weinstock, of Sacramento, one of our most far-sighted men, writes:

What are the causes of the low prices received in the Eastern markets this year for California green fruits, and what, in my opinion, is the remedy?

In reply, I beg to say that so far as I can see them, the causes for the low prices are manifold, and may be enumerated as follows: (1) The glutting of markets; (2) The railway strike; (3) Hard times; (4) Unsatisfactory railway service.

As to the remedy, I shall not attempt to touch upon the matter of the railway strike nor hard times; first, because these were matters beyond our control, and, secondly, because let us trust that hard times may, before another season, be a thing of the past. Nor shall I at this time take up the matter of unsatisfactory railway service. I prefer to leave that issue to others who are better prepared to deal with it. I shall devote whatever space you are prepared to give this answer to your questions to the first, and, to my mind, prime cause for the prevailing low prices, namely: the constant glutting of Eastern markets.

We find ourselves in 1894 back again to similar conditions that existed in 1885 and 1886, with this difference: In those years about 1,000 carloads glutted the markets of the East; this year it takes about 7,000 carloads to do it. The difference between the two figures represents the growth in the volume of our shipments, which growth is largely the result of opening the Atlantic sea-board markets, and many interior markets, by the introduction of the auction plan of selling fruits, a system first introduced in connection with the sale of California fruits in 1887.

In spite of the railway strike, the hard times, and the unsatisfactory railway service, the year 1894 should have been a prosperous year for the California fruit grower, who, so to speak, had for the first time in the history of the fruit industry the great market of the East largely to himself, an opportunity caused by the almost total failure of the Eastern crop, and such as may not again present itself in many years. This golden opportunity, however, was largely wasted through lack of proper and intelligent distribution of his products.

As a rule, the markets of the East were kept constantly glutted, and the prices to the grower thereby made ruinously low. Such having been the case in 1894, with a probable shipment of 7,000 cars, and with the Eastern crop almost a total failure, what is likely to be the result when the California fruit crop will aggregate many more than 7,000 carloads, as it surely will within the next few years, and when the Eastern crop shall be a normal one, or an unusually large one? The answer must be self-evident. There can be but one result, and that result one of disaster to the army of fruit growers in our State, and a serious crippling of the entire green fruit industry of California.

As far back as 1885, when our Eastern shipments did not exceed much over 1,000 carloads of green fruit a season, the cry was already raised that we were over-producing, and that the ruinously low prices received in those years in the East were caused by an over-supply. There were many, even among the oldest and most experienced California fruit men—dealers and growers—who at that time strongly advised that we should stop planting and tear up a portion of the trees and vines already planted. And yet, in spite of these opinions, as soon as the causes for the low prices were removed, and our system of handling our fruits in the East changed, and new markets opened out and developed, we have seen the shipments increased four and five fold at better prices than were obtained when 1,000 carloads and less were shipped in a season, showing plainly that the low prices realized in those earlier years were not caused by over-production, but by a lack of proper knowledge and proper facilities for the handling of the fruit.

All this will, to my mind, apply to present conditions. I, for one, do not believe that in a year like this, with a perfect fruit famine in the East, 7,000 carloads should glut all the great markets east of the Rocky Mountains, especially when it is known that the market of New York City alone has, in the past, without breaking, consumed as many as 5,000 carloads of domestic peaches in one week. The fault is not with the fruit nor with the markets, but with our manner of distribution. Fortunately, this is a matter that can be remedied, and every effort should be made to bring about this remedy as speedily as possible.

During the earlier history of the auction-sale system it was comparatively easy to regulate the distribution of our fruits in the East, from the fact that over 90 per cent of the shipments were made through two mediums, the California Fruit Union and the Earl Fruit Company, which made it possible to more or less regulate its distribution. But within the past year or two new conditions have arisen. In place of the great bulk of the fruit passing chiefly through two hands, a large number of coöperative companies, Eastern brokers, fruit commission men, and others have entered the field, and have been making indiscriminate shipments to the various Eastern markets, resulting in disaster all around. Each shipper has, naturally, endeavored to hide his movements from all others, and the result has been that all have worked in the dark, and the routing of fruit has been almost entirely a matter of guesswork. The wonder is not that the loss has been so great to the grower, but that, under the circumstances, the losses have not been still greater. So long as this unintelligent manner of routing and distributing fruit will continue, so long must disaster follow, with injury to all and benefit to none, excepting, perhaps, for the time being, to the Eastern consumer.

Early this year I foresaw the present results, and advocated the establishment of a Bureau of Information, to be supported by all engaged in shipping fruit, whether growers or shippers, the purpose of this Bureau of Information being to issue daily bulletins to all subscribers, showing the condition of each market, the price realized for the various fruits at the various selling points the preceding day, and the contents and destination of the cars of fruit eastward bound, so that all shippers might each morning have before them a photograph, so to speak, of the situation, and in that way be enabled to more intelligently determine where their fruit should be sent.

Though advocating the plan, I had little hope of its adoption this season, realizing, as I did, that many growers and shippers would be loath to reverse the old-time policy of hiding all information concerning the movement of their fruit and follow a new policy of giving to this proposed bureau the fullest information concerning the movements of their fruit. I realized that it would be a hard matter for them to see the necessity and the wisdom of such a step until serious loss and suffering alone would finally leave them no choice between this—to my mind—progressive step or ruin. The policy of wild-cat system of shipments, continued this present season, with its disastrous results, has, perhaps, done more to prepare the minds of the shippers and growers for the proposed plan than years of writing or speech-making, and I believe that the time is now ripe for the earnest agitation of such a step.

With the auction system now so thoroughly and so successfully established throughout the East; a system which insures the absolute sale of all fruit immediately on its arrival, at the rate of five minutes to a carload; a system which brings to the grower the highest price his fruit is worth at the most favorable moment, which, of course, is immediately on its arrival; a system which gives the grower absolute protection and insures his getting from the Eastern agent every penny his fruit is sold for; a system which practically means spot cash payment on the part of the Eastern buyers, since all



responsible Eastern receivers are expected to remit within twenty-four hours after the sale; a system which makes it possible for the shipper at this end to know the result of the sale on his entire shipment within an hour of such sale taking place—which information formerly did not, as a rule, reach him for weeks; a system which has put all Eastern buyers on a level, and has thereby encouraged many hundreds of Eastern dealers, large and small, to deal in California fruits, who formerly either could not or would not handle our fruits, but who in recent years have worked out so many new channels of trade for our products that our shipments, from 1,000 carloads or less in a season, have increased to nearly 7,000 carloads for 1894—yet, with all the advantages and benefits that have followed the introduction of sale by public auction, the auction system has not been able to make it possible for a market that can use but five carloads a day to use ten carloads a day at an equally fair price. Nor is it possible for the human mind to devise a plan that will make a five-carload market handle at a satisfactory price a ten-carload shipment.

The remedy must lie in the direction of sending to the one-carload market one carload of fruit only; to the five-carload market five carloads of fruit only, and so on. The surplus, if there be any, must be retained at home, dried, sold to canneries, or, if this cannot be done, then it is better that such surplus shall, for the time being, rot on tree or vine, rather than be permitted to go East and there demoralize the prices for the great bulk of shipments which otherwise would yield fair prices.

With proper and intelligent distribution, however, there need, as a rule, be no surplus; at least not for years to come. It is to the end that the glutting of the markets be hereafter avoided, and that our fruits be more intelligently distributed, that the proposed "Bureau of Information" is advocated.

I am informed that the State Board of Horticulture proposes to hold its semi-annual meeting in Sacramento November next. An energetic effort should be made on the part of the Board to make that convention a representative one, and to bring together at that time the largest possible attendance of growers and shippers, with the view of taking up the problem of regulated distribution in the hope of adopting the plan of establishing a Bureau of Information, or some other plan of still greater merit, that others may be able to suggest.

#### ORGANIZATION OF FRUIT EXCHANGES.

One of the important events of the past fruit season has been the perfection of the organization of the California Fruit Exchange. This organization originated under the auspices of the State Board of Horticulture, and was the outgrowth of a desire on the part of the growers for uniformity in methods of grading, packing, and marketing, which uniformity only coöperation on the part of the growers could procure. The matter was brought before the Fruit Growers' Convention at San José in an essay by A. L. Bancroft, and took shape at the next convention, held at Los Angeles, in the form of a set of resolutions, in which the organization was determined upon. The wishes of the growers having been thus definitely manifested, every aid possible was rendered to the new organization until it became strong enough to act independently.

The necessity for, aims, and history of the California Fruit Exchange are set forth in the following paper from the pen of Edward F. Adams, who has had the management of the organization from the beginning:

The evolution of the coöperative movement in California has, during the past year, brought into existence the California Fruit Exchange, which may be briefly described as a general agency for all fruit growers in matters of common interest. These matters of common interest are far more numerous than appear at first sight. For example, the raisin industry and the orange business would seem to have no common bond; but scattered among the orange districts there are a certain amount of raisins, not large enough to support a separate raisin organization, but quite sufficient to seriously impede, without benefit to themselves, the operations of any organization of the great raisin industry centralized in the San Joaquin Valley. It is of great value to the organized raisin industry to be able to make use of the orange growers' organization to gather in the scattering raisins of Southern California to be handled with those of the San Joaquin Valley. The common interest of the citrus and deciduous (fresh) fruit interests are still more obvious. The citrus fruit people need salaried Eastern representation during the winter, and the deciduous fruit shippers during the summer. The channels of trade for the two lines of fruit are identical; it would be very silly for the citrus fruit men to keep an Eastern agent and office half the year, and the deciduous fruit shippers another agent and another office during the other half of the year, when by uniting they can employ the same agent and the same office and get better service with less expense.



All branches of the industry are alike interested in matters affecting transportation, tariff, refrigeration, extension of markets, grading, inspection, brokerage, prevention of consignments, banking facilities, advertisement of California products, cost, character and quantity of competing goods, taxation of orchards, and other matters of general interest, wherein they can be best and most economically served by a common expense. It is also true that if organization is maintained it can only be by constant "promotion" overcoming the disintegrating influences which are constantly at work. The State Exchange is designed to represent and act for the fruit growers of the State in regard to all these matters. Incidentally it may itself sell fruit, as it is doing this year. Logically, however, it ought to sell no fruit unless it sells all of it, because it assumes to represent all growers, or at the least all who contribute to its support, alike, but if it undertakes the sale of a portion of the fruit it must become a competitor of those whose fruit it does not sell, and yet who contribute to its support. This position is logically false, and has in it the seeds of death. In its final form the Exchange must render to all equal services at equal cost.

The California Fruit Exchange originated—or at least took form—at a meeting of the State Horticultural Society held at San José in October, 1893, at which a committee was raised to "organize a State Exchange for the marketing of California's product of dried fruit, prunes, raisins, almonds, nuts, beans, honey, etc.," with instructions to appoint the first Board of Directors from their own number. The committee performed its duty as instructed, appointing a Board of seven Directors, who promptly organized and elected a manager. It was agreed, however, that the Directors so appointed should serve only until the fruit growers of the State could be further consulted, and determined, by a State Convention specially called, whether the organization should be made permanent, and if so, who should serve as Directors for the first full year. This convention was called by the State Horticultural Society, at the request of the Directors of the Exchange, and met in San Francisco on December 27th. This convention—in which twenty-six counties were represented—formally resolved: "That this convention approves, and, on behalf of the fruit growers of California, accepts the work done under the resolution adopted by the State Horticultural Society at its October meeting in San José, recognizing hereby the California Fruit Exchange as now organized as an authorized representative of the fruit growers of California."

The convention also determined that the number of Directors should be eleven. The Directors subsequently incorporated the Exchange under date of January 23, 1894. The authorized capital of the Exchange is \$100,000, of which, at this writing, but a small portion has been subscribed.

During the present year the main duty of the Exchange has been that of organization. The plan of organization is that of promoting local incorporated associations which should deal with individual growers, and in behalf of them with other associated growers through the medium of the State Exchange, which is their joint agent for common purposes. As the Exchange, also, to perform its functions, must have adequate capital, its stock was offered for sale, but not pushed with the vigor which would have been used had growers been in better financial condition, and had the financial plans of the Exchange been more fully matured. It has been necessary to determine the exact uses for which capital is required, the amount needed, and the precise methods by which it may be safely guarded, and made, while promoting the interests of growers generally, to earn reasonable dividends to those who supply it. At this writing these matters are becoming gradually shaped in the minds of the management of the Exchange, and by the time it appears in print it is presumed that good progress will be made in this essential part of the movement.

The degree of success which the Exchange may ultimately attain will depend on the financial support which growers give it. Financial support invariably secures moral support. There are growers enough who really desire to cooperate to enforce the adherence of the residue if they choose to endow an Exchange with the necessary capital, and supply it with the revenue necessary to secure the services of a competent management. Money is power in cooperation as in other things, and it is for the growers to determine whether this power shall be used for them or against them.

The fundamental idea of the Exchange is the financial independence of the grower, and the management of the fruit output of the State substantially as if it were owned by one person. All the details of operation are involved in these two generalizations. The aggregate credit of any community is sufficient for its aggregate necessities. If it were not so the community would disintegrate. Cooperation enables the aggregate credit to be pledged for the benefit of the weak without danger to the property of the strong. This would seem impossible, but the explanation is simple. While the needs of the poor man are small, they are urgent, and the securities which he can give, while not such as sound banking can consider, are perfectly good in the hands of his neighbors engaged in the same business and experts therein; and these neighbors can much better afford the care and management of the securities than to suffer the demoralization of the markets incident to the sacrifice of the poor man's crops. The aggregate credit can then be pledged for the benefit of those who need it, and the market is protected from anything but a general over-production involving the credit of all.

The advantage of marketing the entire product of an industry under the direction of the ablest of those engaged in it, and the justice of taxing the entire output for the necessary expenses incurred for the benefit of all, are too obvious to require discussion. It is also unnecessary to speak of the convenience and comfort which these methods bring to the weak, who are thus able to lean on the strong arm of society, and to those of

the strong who desire to relieve themselves of the burden of detail. Such matters, and the detailed operations by which these results are sought, are fully discussed in the periodical press and in the documents issued by the various societies. What result may follow from the effort now making cannot be foretold. That some valuable advantage is to be secured is now evident, but to what extent and how rapidly our fruit growers may develop the power to manage their own business wisely, depends on the ability of society to digest and assimilate common sense in business affairs. It is an experiment with human nature not tried on this scale before.

In the line of coöperation the orange growers of Riverside have determined to work together in the marketing of their products. A few growers kept aloof from the association for some time, in the hope of getting the increased price of their products without bearing any of the expense incurred. The Directors of the Fruit Exchange passed a resolution that their organization should disorganize unless 90 per cent of the growers would sign the contract. August 15th was set as the time limit, and by this date enough signatures had been secured to insure the permanency of the Union. Riverside's orange crop this season is estimated at 3,000 to 4,000 carloads, and represents one half the total output of Southern California. The abandonment of the coöperative movement here would necessarily seriously injure, if it did not destroy, it elsewhere, and hence every effort was made to keep the Exchange alive.

This work has resulted in the central organization, with headquarters in San Francisco, and local organizations throughout the State, of which the following is a partial list:

*Santa Clara County Fruit Exchange .....	San José.
*West Side Fruit Growers' Association .....	Santa Clara.
*Willow Glen Fruit Union .....	Kensington.
*East Side Fruit Growers' Union .....	San José.
*Berryessa Fruit Union .....	Berryessa.
*Campbell Fruit Union .....	Campbell.
*Riverside Fruit Exchange (citrus) .....	Riverside
*Semi-Tropic Fruit Exchange (citrus) .....	Los Angeles.
*Orange County Fruit Exchange (citrus) .....	Santa Ana.
*San Antonio Fruit Exchange (citrus) .....	Pomona.
*San Diego Fruit Exchange (citrus) .....	San Diego.
*Colton Fruit Exchange (citrus) .....	Colton.
*Duarte Fruit Exchange (citrus) .....	Duarte.
*Contra Costa County Fruit Union .....	Martinez.
*California Fruit Association .....	Vacaville.
*Producers' Raisin Packing Company .....	Fresno.
*Easton Packing Company .....	Easton.
*Hanford Dried Fruit and Raisin Company .....	Hanford.
*Hanford Raisin Company .....	Hanford.
*Alliance Business Association .....	Armona.
*Penryn Fruit Company .....	Penryn.
*Napa Dried Fruit Company .....	Napa.
*Coöperative Fruit Company .....	Newcastle.
*Florin Coöperative Fruit Company .....	Florin.
Vacaville Dried Fruit Exchange .....	Vacaville.
Highland Fruit Association .....	Pasadena.
Mount Shasta Fruit Association .....	Anderson.
*Glendale Fruit Growers' Union .....	Glendale.
*Colfax Mountain Fruit Company .....	Colfax.
Sutter, Butte, and Yuba County Fruit Exchange .....	Yuba City.
Santa Cruz County Fruit Union .....	Santa Cruz.
Santa Cruz Mountain Fruit Exchange .....	Wrights.
Corralitos Coöperative Drying and Canning Company .....	Corralitos.
Sonoma County Fruit Exchange .....	Santa Rosa.
Kern County Fruit Exchange .....	Bakersfield.
Pajaro Valley Fruit Exchange .....	Watsonville.
Niles Coöperative Fruit Union .....	Niles.
Pomona Fruit Growers' Association .....	Pomona.
Kingsley Deciduous Fruit Association .....	Pomona.
East Side Fruit Growers' Union .....	Pomona.
Oswald Fruit Association .....	Yuba City.

\*Organized before the State Exchange.

The Los Nietos and Ranchito Walnut Growers' Association have accomplished a good work in the marketing of their crop, and reports from them are that all is moving with them in the most satisfactory manner.

J. A. Montgomery, Secretary of the association, furnishes the following report of that association's crop and sales, together with the prices received for the year 1893: Total number of sacks of walnuts, 12,936; weight, 1,373,923, or 80 carloads, for which the association received \$90,804 43. First grade hard-shells netted the association per 100 pounds, \$6 33½; second grade hard-shells, \$4 40; first grade soft-shells, \$7 40; second grade soft-shells, \$5 64. Received by growers, \$87,463 17; cost of sacks, \$1,979 95; expense of handling crop, \$949 15; total, \$90,-392 27.

More inharmony has been reported between the raisin growers and packers. A crisis was reached on August 15th, when the new organization known as the State of California Raisin Growers and Packers' Association met a number of packers who had not signed the roll for the purpose of fixing a schedule of rates. The outcome, however, was satisfactory, and there was a disposition evinced on the part of the packers to work in harmony with the growers. The principal matter before the meeting was the fixing of the schedule of prices for the coming season. The packers were first consulted as to the minimum price of 3-crown raisins, which were accepted as the standard, other grades being rated up and down on this basis. In fixing the price the meeting had but one aim: To establish a rate as high as possible, but they had to allow for the competition of Spanish raisins and of the product of the El Cajon vineyards in San Diego County, which have already been offered for 3¼ cents. The discussion of a rate consumed almost the entire day, when a decision was finally reached in favor of 3¾ cents. The rest of the grades were quickly arranged as follows, the rate being given in cents:

	Per Pound.
Four-crown, loose .....	4½
Three-crown, loose .....	3¾
Seedless, loose .....	3
Two-crown, loose .....	3
Dry grapes, loose .....	2½
Sultanas, loose .....	4

The following prices were adopted for layers, clusters, faced and unfaced raisins, the prices being per box of twenty pounds:

Three-crown layers .....	\$1 35
Four-crown fancy clusters .....	1 60
Five-crown Dehesa clusters .....	2 00
Six-crown Imperial clusters .....	3 00
Four-crown (unfaced) .....	1 15
Four-crown (faced) .....	1 25

It is estimated that about 65 per cent of the output has been secured. About 2,000 of the 3,000 acres in Kings County have been secured, and almost all of Madera County.

#### NEW FRUIT CLASSIFICATION.

A movement looking to the application of California names to California fruit, and the discarding of the foreign names under which much of it has heretofore been sold, was inaugurated by the Directors of the California Fruit Exchange. The reasons for this movement are obvious. California is to-day one of the leading dried fruit countries of the world;



her products have a world-wide reputation and stand at the head of their kind. This being the case, there is no reason why they should not stand on their own merits, or why the shift of resorting to foreign names of inferior fruit for our superior products should be resorted to. It is for this reason that the new movement has been adopted, and hereafter California fruits will reach the markets under their own distinctive titles. The following is the classification schedule which has been adopted and under which the various fruits will be known:

*Raisins*—California clusters, in place of clusters, Spanish style.

No. 1 California layers, substitute for 4-crown London layers.

No. 2 California layers, in place of 3-crown London layers.

No. 1 loose, in place of 3-crown loose; No. 2 loose, in place of 2-crown loose; and

No. 3 loose, in place of 1-crown loose.

*Seedless Muscatel*—No. 1, Thompson seedless; No. 2, Thompson seedless; No. 1, Sultan; No. 2, Sultanas.

*Apricots*—Made from fruit one and three fourths inches in diameter:

No. 1—1, bright in color; 2, free from dirt, etc.; 3, meaty fruit.

No. 2 D—1, bright in color; 2, free from spots, dirt, etc.; 3, meaty fruit.

Made from fruit one and a half inches in diameter:

No. 2—1, bright in color; 2, free from spots, etc.; 3, meaty fruit.

No. 3 D—1, bright in color; 2, free from spots, etc.; 3, meaty fruit.

No. 3—1, bright in color; 2, free from spots, etc.; 3, meaty fruit.

No. 4 D—1, bright in color; 2, free from spots, etc.; 3, meaty fruit.

No. 4—Includes all not placed in the above classes.

*Peaches* made from fruit two inches in diameter and upward:

No. 1—1, bright in color; 2, free from spots, etc.; 3, meaty fruit.

No. 1 D—1, bright in color; 2, free from spots, etc.; 3, meaty fruit.

Made from fruit one and a half inches in diameter:

No. 2—1, bright in color; 2, free from spots, etc.; 3, meaty fruit.

No. 2 D—1, bright in color; 2, free from spots, etc.; 3, meaty fruit.

No. 3—All not in above classes.

*California Prunes* to be known as "California Prunes." Grading according to the number to the pound: 40 to 50, 50 to 60, 60 to 70, 70 to 80, 80 to 90, 90 to 100, 100 to 120 and above.

*Silver Prunes* are classified as follows: No. 1, bright in color; 1 D, brown in color; 2, bright; 2 D, brown.

*Pears* classified as follows: No. 1, halves, large, bright and clean. All others by description or sample.

"D" indicates that the product is slightly off in some one of the three marked characteristics of the grade.

"D" prunes include four classes, equal quantities to each: No. 1, 60 to 70; 2, 70 to 80; 3, 80 to 90; 4, 90 to 100.

#### NEW PLANT FOR 1894.

Returns received from twenty-one counties—Alpine, Colusa, Del Norte, Glenn, Inyo, Kern, Los Angeles, Napa, Nevada, Orange, Placer, Riverside, Kings, Madera, San Diego, San Joaquin, Santa Barbara, Santa Clara, Santa Cruz, Sonoma, and Tehama—show an increased acreage of fruit planted in the spring of 1894, of 17,000 acres. The principal fruits have been peaches, prunes, and apricots, in their order. In San Diego the largest plant was to olives, and the second largest to lemons. In Kings, Placer, Sutter, and Kern Counties, peaches and apricots held the first two places. In San Joaquin, Santa Clara, Santa Cruz, and Glenn, prunes and apricots were the favorites; in Los Angeles, prunes and walnuts came first and second; in Riverside, oranges and prunes, and in Madera, raisins and peaches. Returns from Colusa, Del Norte, Napa, Nevada, Santa Barbara, and Sonoma are to the effect that there is no increase in the total acreage of fruit in these counties, and that the new plant has not been more than sufficient to compensate for the loss of the old.

The above figures will cover over half the principal fruit sections of the State, and an estimate of 35,000 acres of new land to all kinds of fruit planted in the present season will probably be as nearly accurate as an estimate could be made.









NONPAREIL.











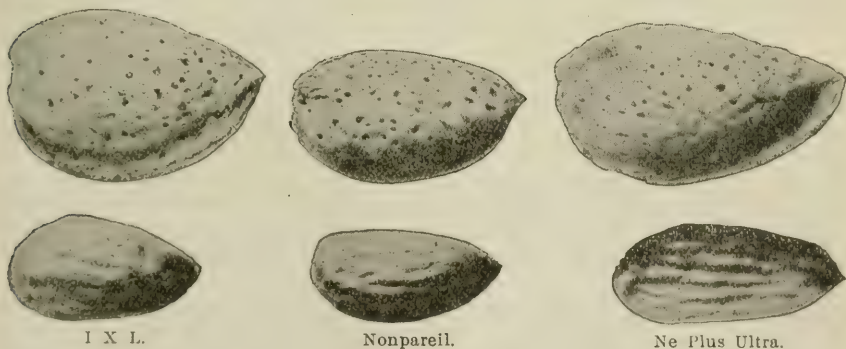
LA PRIMA.





## CALIFORNIA ALMONDS.

The almond produced in this State comes into competition at the East with almonds imported from Europe. A century of such trade has naturally given nuts of foreign name a standing in the Eastern markets. Selling by their familiar names, they have the advantage of the California product which is new to the Eastern trade. The result has been that California growers have not hitherto obtained, as a rule at least, the prices secured by the imported nuts sold by their familiar and favorite names. The experience is the same as that which our growers of prunes, raisins, etc., have had to surmount. These products have now largely overcome their disadvantages and accomplished it by convincing consumers that the California articles were superior to the imported. The same course is necessary to place the almond upon a fair commercial basis at the East, and it is toward this end that the State Horticultural Society has made the following declaration on the subject:



### VALUE OF CALIFORNIA ALMONDS AS COMPARED WITH OTHERS.\*

During the past twenty years California has originated thousands of varieties of almonds in her efforts to obtain something better than those in use. She was successful in her undertaking, having obtained several varieties of thin-shelled, good-flavored nuts. We claim, and the figures in the table below show that the claim is fully maintained, that in our California climate we can grow almonds with much more kernel and much less shell than those sent into the United States from abroad.

The information here given will be found useful to those who deal in almonds, and of value to those who use them, as it will show the varieties to buy in order to get the best returns for the money expended.

\* By the State Horticultural Society.

## GRADES OF ALMONDS.

They are divided into four grades, viz.:

*Hard-shell*, including those bearing but 6 ounces or less of kernel to a pound of nuts. They require a sharp blow with a hammer to crack them.

*Soft-shell*, those having from 6 to 8 ounces of kernel to a pound, and require the use of nut-crackers to crack them.

*Extra Soft-shell*, having from 8 to 10 ounces of kernel to a pound, and can be readily broken with the fingers.

*Paper-shell*, having 10 ounces or more of kernel to a pound. A child can easily open them with its fingers.

These grades and this statement have been approved by the California State Horticultural Society, and are thus made official.

*One Pound of Almonds, showing the Weight of the Kernel, the Weight of the Shell, and Relative Value of the Leading California Varieties with others.*

The Terragona is the leading and best known variety throughout the entire United States, and is imported from Spain in large quantities. It is therefore taken as the standard, and other varieties are compared with it.

Variety.	Grade.	Weight of Kernel, in Ounces.....	Weight of Shell, in Ounces.....	Relative Value per Pound, in Cents, Commencing with Different Rates.					Percentage of Value More than the Terragona.....
Terragona .....	Soft-shell .....	6 $\frac{2}{3}$	9 $\frac{3}{4}$	12 $\frac{1}{2}$	15	17 $\frac{1}{2}$	20	0	
Languedoc .....	Soft-shell .....	7 $\frac{1}{2}$	8 $\frac{1}{2}$	14 $\frac{1}{2}$	17 $\frac{1}{2}$	20 $\frac{1}{2}$	23 $\frac{1}{2}$	17 $\frac{1}{4}$	
El Supremo .....	Soft-shell .....	7 $\frac{1}{2}$	8 $\frac{1}{2}$	14 $\frac{1}{2}$	17 $\frac{1}{2}$	20 $\frac{1}{2}$	23 $\frac{1}{2}$	17 $\frac{1}{4}$	
Drake's Seedling .....	Soft-shell .....	8 $\frac{3}{4}$	7 $\frac{1}{4}$	17	20 $\frac{1}{2}$	24	27 $\frac{1}{2}$	36 $\frac{3}{4}$	
I X L .....	Extra Soft-shell .....	9	7	17 $\frac{1}{2}$	21	24 $\frac{1}{2}$	28	40 $\frac{3}{4}$	
Commercial .....	Extra Soft-shell .....	9 $\frac{1}{4}$	6 $\frac{3}{4}$	18	21 $\frac{1}{2}$	25	29	44 $\frac{1}{2}$	
La Prima .....	Extra Soft-shell .....	9 $\frac{1}{2}$ -10	6 $\frac{1}{2}$ -6						
La Prima .....	Extra Soft-shell .....	When 9 $\frac{1}{2}$	6 $\frac{1}{2}$	18 $\frac{1}{2}$	22 $\frac{1}{4}$	26	29 $\frac{1}{2}$	48 $\frac{1}{2}$	
La Prima .....	Extra Soft-shell .....	When 10	6	19 $\frac{1}{2}$	23 $\frac{1}{4}$	27 $\frac{1}{2}$	31	56 $\frac{1}{4}$	
Princess .....	Paper-shell .....	9 $\frac{1}{2}$ -10 $\frac{1}{4}$	6 $\frac{1}{2}$ -5 $\frac{3}{4}$						
Princess .....	Paper-shell .....	When 9 $\frac{1}{2}$	6 $\frac{1}{2}$	18 $\frac{1}{2}$	22 $\frac{1}{4}$	26	29 $\frac{1}{2}$	48 $\frac{1}{2}$	
Princess .....	Paper-shell .....	When 10 $\frac{1}{4}$	5 $\frac{3}{4}$	20	23 $\frac{3}{8}$	28	32	60	
Ne Plus Ultra .....	Paper-shell .....	10	6	19 $\frac{1}{2}$	23 $\frac{1}{4}$	27 $\frac{1}{2}$	31	56 $\frac{1}{4}$	
King's Soft-Shell .....	Paper-shell .....	10	6	19 $\frac{1}{2}$	23 $\frac{1}{4}$	27 $\frac{1}{2}$	31	56 $\frac{1}{4}$	
California Paper-Shell .....	Paper-shell .....	11	5	21 $\frac{1}{2}$	25 $\frac{3}{4}$	30	34 $\frac{1}{4}$	71 $\frac{3}{4}$	
Nonpareil .....	Paper-shell .....	11-13	5-3						
Nonpareil .....	Paper-shell .....	When 11	5	21 $\frac{1}{2}$	25 $\frac{3}{4}$	30	33 $\frac{1}{2}$	71 $\frac{3}{4}$	
Nonpareil .....	Paper-shell .....	When 12	4	23 $\frac{1}{2}$	28 $\frac{1}{4}$	32 $\frac{3}{4}$	37 $\frac{1}{2}$	87 $\frac{1}{2}$	
Nonpareil .....	Paper-shell .....	When 13	3	25 $\frac{1}{2}$	30 $\frac{3}{8}$	35 $\frac{1}{2}$	40 $\frac{1}{2}$	103	

*Note.*—The weights here given are the results obtained by carefully weighing the samples submitted. The comparative weights of kernel and shell of the same varieties vary somewhat when grown in different localities; in the nuts of the same kind grown on trees of different ages; and also one season with another even when grown upon the same trees.

## VARIETIES OF ALMONDS.

A short description of the several varieties is here given.

*Terragona*, 6 $\frac{2}{3}$  oz. kernel; 9 $\frac{3}{4}$  oz. shell. Soft-shell. A Spanish almond imported into the United States in large quantities. Short and thick. Shell thick and inclined to be hard. It cannot be broken with the

fingers, nut-crackers being required. It is to-day the leading and best known variety in the United States markets. The Terragona is the soft-shell almond of the United States; but notice the *value* of it in comparison with the other varieties, based upon its proportion of kernel and shell, as shown in the accompanying table.

*Ivica*, (?) oz. kernel; (?) shell. Soft-shell (?). A Spanish almond of poor quality as compared with any of the California varieties.

*Languedoc*,  $7\frac{1}{2}$  oz. kernel;  $8\frac{1}{2}$  oz. shell. Soft-shell. A standard variety; nut large and kernel sweet. The California almond known to the trade as soft-shell.

*El Supremo*,  $7\frac{1}{2}$  oz. kernel;  $8\frac{1}{2}$  oz. shell. Soft-shell.

*Drake's Seedling*,  $8\frac{3}{4}$  oz. kernel;  $7\frac{1}{4}$  oz. shell. Soft-shell. A California seedling, originated by Mr. Drake, of Suisun. It is of the Languedoc class; short, plump, with many double kernels.

*I X L*, 9 oz. kernel; 7 oz. shell. Extra soft-shell. A California seedling, originated by Mr. A. T. Hatch. An ideal almond shape; not over long, with a perfect shell. Kernels, as a rule, single, and of excellent flavor. A very attractive and popular variety for table use unshelled.

*Commercial*,  $9\frac{1}{4}$  oz. kernel;  $6\frac{3}{4}$  oz. shell. Extra soft-shell.

*La Prima*,  $9\frac{1}{2}$  to 10 oz. kernel;  $6\frac{1}{2}$  to  $5\frac{3}{4}$  oz. shell. Paper-shell. A California seedling, originated by Mr. A. T. Hatch. But few double kernels. Long; very much like the *Ne Plus Ultra*.

*Princess*,  $9\frac{1}{2}$  to  $10\frac{1}{4}$  oz. kernel;  $6\frac{1}{2}$  to  $5\frac{3}{4}$  oz. shell. Paper-shell. The nut rather short and small. Kernel flat and somewhat wrinkled. The shell rather imperfect and ragged. Imported in small quantities from Italy.

*Ne Plus Ultra*, 10 oz. kernel; 6 oz. shell. Paper-shell. A California seedling, originated by Mr. A. T. Hatch. Rather large and long, having almost invariably a single kernel. The kernel long and slender, resembling the imported Jordan almond.

*King's Soft-Shell*, 10 oz. kernel; 6 oz. shell. Paper-shell. Originated in San José, California. Short, with a sharp point. Dark color. Shell thin, soft, rough, and somewhat imperfect. Kernel white, large, flat, and wrinkled. Sweet and relishing.

*California Paper-Shell*, 11 oz. kernel; 5 oz. shell. Paper-shell. Short, with a sharp point. Shell rough and imperfect. Kernel white, large, flat, and wrinkled. Sweet and relishing.

*Nonpareil*, 11 to 13 oz. kernel; 5 to 3 oz. shell. Paper-shell. A California seedling, originated by Mr. A. T. Hatch. Has invariably single kernels, and is of superior flavor. When grown on young trees the shells are very thin and somewhat imperfect. On account of the large proportion of kernel to the pound of unshelled nuts it is a very desirable variety.



## TANNIN PLANT—CANAIGRE.

Various articles on a species of *Rumex* or *Dock*—the cañaigre—for tanning purposes, having lately appeared in the papers, many giving conflicting accounts, the subject is deemed of sufficient importance to here describe the plant and all the species with illustrations.

The cañaigre is one of the oldest weeds known on the Pacific Coast, being greatly used for different maladies, especially sore throat. The name cañaigre, given to this plant by botanists, is a confusion of the Spanish name for it "Caña Agria," meaning sour cane. Of late much has been said and written of its tannic qualities, and many are now turning their attention to its cultivation, especially since an extract factory has been established in New Mexico.

There are several species of Dock (*Rumex*) found on the Pacific Coast. *Rumex venosus*, Pursh., is found in dry sandy valleys from British Columbia to Nevada and Colorado. *Rumex occidentalis*, Watson, from Alaska to Sacramento, and eastward to New Mexico and Colorado, and in Labrador, but only rarely collected in California, and has only been found in some of the northern counties, aside from Sacramento, *i. e.*, Shasta, Siskiyou, and Humboldt. *Rumex salicifolius*, Weimann, in the valleys throughout the State and along the coast, ranging northward to Alaska, and eastward across the continent. *Rumex berlandieri*, Meisner, in Colorado, and eastward to New Mexico and Texas. *Rumex crispus*, Linn. (yellow dock), has been collected almost everywhere in the State, along the rivers, creeks, and low lands; grows in pastures and among field crops, and is quite difficult to exterminate. This species is also known by the name of "curled dock." *Rumex conglomeratus*, Murray, originally from Europe, and found throughout the entire length of the State. *Rumex maritimus*, Linn., very common in the moist valleys of Washington, and eastward to New Mexico, and on the Atlantic coast, and in Europe and Northern Asia. *Rumex obtusifolius*, Linn. (bitter dock), European, quite widely spread, and hard to exterminate. *Rumex pulcher*, Linn., a species of the Mediterranean region, found along the moist valleys along the coast. *Rumex panicifolius*, Nutt., in the Sierra Nevada, and northward to Washington, ranging east to Montana and Utah. *Rumex asteosella*, Linn. (red sorrel), a very common and widely spread weed from Europe; spreads very rapidly.

*Rumex Hymenosepalus*. Torrey.

(Caña Agria—Cañaigre.)

Found in dry, sandy places from Colorado, and eastward to Utah and New Mexico. In California, along the Sacramento and San Joaquin Rivers, in the San Joaquin Valley and throughout the southern part of the State, from San Luis Obispo down to Lower California, Mexico, Arizona, New Mexico, Texas, Louisiana, and Florida, and in the Island of Cuba. *Rumex* is the old Latin name known as *dock*, and belongs to the order

*Polygonaceæ*. A large genus of perennial or rarely annual herbs, sometimes sub-shrubs, rarely tall shrubs, distributed throughout all temperate climates. Flowers fasciculate in the nodes, fascicles axillary or disposed in terminal racemes or panicles. Leaves sometimes all radical, sometimes alternate on the stems and branches. The species are mostly worthless, and in some cases very troublesome weeds. *Rumex hymenosepalus* is the most valuable and greatly used in medicine. It greatly resembles the rhubarb and has often been substituted for it, and the fleshy leaves for spinach. The cane has a pleasant acid taste, almost identical to the stem of rhubarb. It will grow in any locality in the State suitable for the culture of the potato. It requires a loose, moist, sandy soil (and must be irrigated to give the best returns, excepting on moist river-bottom lands). The roots of the cañaigre were used by Indians and others in Texas, in and about San Antonio, for tanning purposes, more than fifty years ago. The roots of the cañaigre are produced in clusters, like sweet potatoes, many being of enormous size. From an analysis made by the Department of Agriculture, and the Arizona Experiment Station, it appears to contain from 23 to 33 per cent of tannic acid. The plant starts its growth very early in the spring and rapidly matures, after which the leaves die; the roots remain in a dormant condition for many months. The roots are of a dark brown color externally, a deep brown color internally, and of a peculiar odor. Both the fresh and the dried roots have a very astringent taste. By the analysis made (here mentioned), the fresh root was found to contain 68.07 per cent of moisture, the tannin equaled 8.51 per cent, or 26.62 per cent when calculated to free water substance. The dried roots containing 11.17 per cent of moisture, contain 23.45 per cent of tannic acid, equivalent to 26.30 per cent of tannin in strictly dry root, and from the close agreement in the tannin estimates in the fresh and dried roots, the tannin was not affected by long keeping.

The analysis made by the Arizona Experiment Station during the different months of the year 1892-3, of dried samples, showed the following per cents:

1892—January 4 .....	16.7
August 2 .....	18.2
September 3 .....	23.1
October 5 (average of new roots from 50 plants) .....	23.0
Highest .....	25.4
Lowest .....	15.7
November 16 .....	24.4
1893—January 10 .....	25.0
January 17 .....	28.2

On October 15th, a root analyzed in the green state contained 7.4 per cent, and in dried, 22.2 per cent tannic acid. When dug, January 17th, it had a bunch of six small roots, three inches long and one half inch in diameter.

	Weight, in Grams.	Per Cent Tannin in Green Root.	Moisture.	Per Cent Tannic Acid in Dried Root.	Total Weight in Tannic Acid.
Old root .....	148.3	10.0	71.3	32.0	14.80
New root .....	39.2	3.9	76.4	15.1	1.52
Leaves and stems .....	94.0	0.8	80.0	3.9	0.79

*Moisture in Roots.*

Green roots, average of all samples.....	66 per cent.
After being sacked two months.....	58 per cent.
After lying in open box one year.....	32 per cent.
Sliced and dried.....	8 per cent.

By which it will be seen that 3 tons of green roots will make 1 ton of cut and dried roots, containing about 30 per cent tannic acid.

*Extract in Cut and Dried Root.*

Average extract matter.....	45 per cent.
Average purity of tannic acid in extracted matter.....	66 per cent.

By which it will be seen that 6 tons of green roots, or 3 tons of dried roots, will make 1 ton of extracted matter, containing 66 per cent tannic acid, if all loss is avoided.

This tannic acid is of the variety known as rheo-tannic acid, is identical with that existing in rhubarb, and the analysis did not show any substances that would prove injurious to leather.

This important subject naturally suggests itself to intelligent experimenters and as one well worth a trial, for we have the climate and soil adapted to its natural growth, and if the demand warrants its culture, in a few years it could take the place of cutch and gambier, of which something like 20,000 tons are imported annually into the United States.

*Propagation.*

The habits of the cañaigre are very similar to the rhubarb. It completes its annual growth in a few months; during the remainder of the year only the withered leaves and dry stalks are to be seen above ground. The cañaigre puts forth very early in the spring and, like the rhubarb, it is then that it requires constant care and cultivation to have the plants give the best results, because by May and June their growth is over; the leaves then die down, and the roots lie dormant the balance of the season. The roots, however, being fleshy, deep-seated, and tuberous, are full of moisture, retain their vitality throughout the summer, and start new growth as soon as the rains come, on the following winter. The plate herewith given is from the report of the Department of Agriculture for 1868, and while somewhat poor, gives a fair idea of the habit of growth of this plant.

Bulletin No. 7 of the Arizona Experiment Station gives the following account, which corresponds with my observations:

In this locality the plant appears above ground shortly after the winter rains—last year the first of February. It grows rapidly, and by the last of April it is in full bloom. Before the close of the following month it has matured its seeds, and the part above ground has withered and dried. Its annual period of growth only extends over a few months. If we have fall and early winter rains, the plant begins its growth during November and December. The winter of this climate is not of sufficient rigor to destroy the foliage. If the plant starts its growth before the close of the fall months it will continue in growth throughout the winter, and will produce a much thriftier growth before the drought of the succeeding summer. The plant propagates itself mostly by its large fleshy roots. It flowers profusely; but very few seeds are matured, the greater number withering and falling before ripening. We are inclined to think that very few of the seeds that do mature germinate and produce new plants. The seeds maturing in early summer fall to the ground, and for several months lie there the prey of insects and birds. A diligent search several times in as many different places failed to discover a single seedling, and this in regions where the plant was very abundant. Possibly, in a measure, this failure to produce seed may be attributed to the proterogynous and anemophilous condition of the flowers. This is especially true in places where the plants are not numerous. Some two or three days before the stamens are ready to shed their contained pollen, the rather long, three-parted, plumous style curves back at each angle of the achene, the parts projecting between the three inner bracts of the floral envelopes. These bracts only spread as they are crowded apart by the developing stamens.

The flower hangs downward, suspended by the rather long-jointed, filamentous pedicel.



As the pollen ripens the stamens are swayed back and forth by the slightest breeze, and the scattering pollen is carried by the wind to the younger flowers, the stigmas of which are at this time ready to receive it.

The leaves are large, thick, and succulent, as a rule presenting about as much of one surface to the sun's rays as the other. Both surfaces are very similar, the large mid-rib being a little more prominent on the under side. The epidermal cells and the form and number of stomata above are about the same as are found below. The mesophyll is almost entirely of palisade tissue, which has the appearance of a deep, rich green velvet when the epidermis is stripped off.

This plant varies to a great extent, both in firmness and general appearance of roots, and in size and appearance of leaves and stem. In some plants the leaves are broad and smooth; in others, narrow and very wavy margined. In some the bracts of the penanth are two or three times as large as in others and much more highly colored.

Many letters are constantly being received and questions asked regarding the probable returns per acre. This we cannot answer, because no plantations have yet been made in our State. The following from the Arizona Experiment Station at Tucson, where the plant has been largely grown, will no doubt prove of interest:

While the result of our investigations to the present time with such data as we have collected from other sources will not enable us to give positive replies to the many inquiries we receive, enough has been demonstrated to show that the cañaigre plant possesses sufficiently valuable qualities to warrant its cultivation on a large scale.

The amount exported during the past two years shows there is demand, at paying prices, for large quantities, and one of the greatest obstacles in starting an industry introducing a new product to the trade, is largely overcome. There is room for a large industry in growing and shipping the roots in a dried state, but the cost of labor in slicing and drying, and the bulky condition of the product after they are thus prepared, stands in the way of the most rapid development.

The cañaigre crop has this advantage over sugar cane and the sugar beet: it can be prepared for market without expensive machinery for manipulation, but as the field of production is a long distance from places of consumption, economy in transportation demands the extraction of the valuable element and placing it in condensed form. It is important, therefore, that extract factories be established on a large scale, and that they be located on lines of transportation, and where the lands in the immediate vicinity of the works may be planted to cañaigre.

Our investigations in the laboratory, which are simply referred to in this bulletin, and which are still in progress, show that there is no more difficulty in extracting the tannic acid from the roots, green or dried, than in separating sugar from cane and from beets. As in sugar making, the extraction will have to be done on a large scale and with expensive apparatus, but the returns will fully justify the investment.

The industry should be built on two lines, growing and manufacturing, the same as has been found most desirable and profitable in sugar production. Capital must first be secured to build factories, after which there will be no difficulty in making contracts with persons to supply cañaigre roots, at stipulated prices per ton.

*Time of Planting.*—It seems not to matter seriously when the roots are planted, the formation of new roots beginning in the fall from the latter part of September and continuing on until March or April. If planted in the late spring, leaves will appear and lie down at the usual time in May, when the root planted will lie dormant through the summer and begin the formation of the new crop of roots at the regular season, with no apparent advantage or disadvantage as compared with roots planted just before the growing season. If the soil is kept dry, they may lie over until the next year, and then proceed to grow in the usual way when moisture is supplied.

Under cultivation the habits of the plant may be modified to some extent, and we may find on further investigation that our present conclusions are somewhat in error in regard to the particular habits of growth of the plant.

*Time of Harvesting.*—With the crop planted in the fall, as has been stated, growth above ground ceases the following May, but the roots, although they remain dormant, grow gradually richer in tannic acid during the year, but the increase is quite slow after July. With rain or irrigation in the fall, the leaves appear above the ground and a new bunch of roots is started; but so far as we have observed, the entire hill will produce no more new roots than would each single tuber if they are separated and replanted. In fact, we are inclined to think the single tuber will produce a larger new crop than the entire hill.

A point we have not yet determined is, whether or not the one-year-old roots increase in size the second year. They certainly grow richer in tannic acid. If they continue to grow, it may be found most profitable to allow the crop to remain on the land two years; if not, the crop had better be harvested when the roots are one year old, and the land replanted.

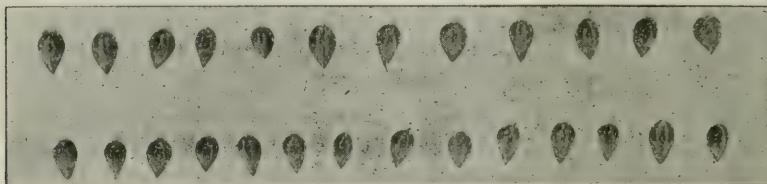
*Yield per Acre.*—Commencing to irrigate by the first of October, a crop of 10 tons to the acre is a reasonable estimate for new land, if the soil is fairly well prepared, and a good stand is secured by planting selected tubers of wild growth. The second year's crop,

from cultivated tubers one year old, should reach 15 tons, and 20 tons is within the possibilities on good land carefully planted and well taken care of.

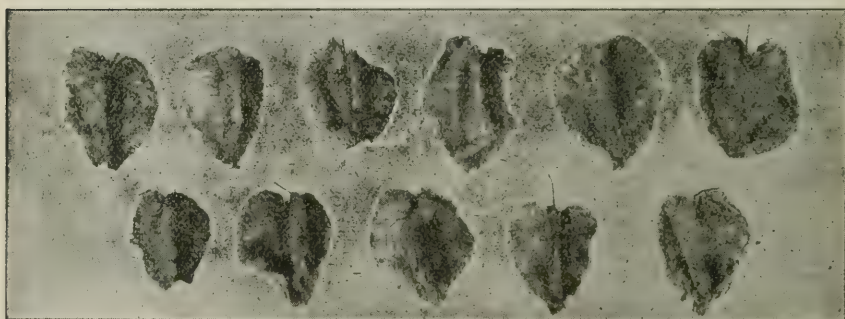
*Cultivation.*—On new desert land, cultivation of the crop will consist of running a cultivator between the rows after each irrigation. On old land that has become set with weeds, some extra work may be necessary to keep them down, but as the ground is prepared during the summer and the growth occurs in the winter and spring, the ground being shaded during the later stage of growth, weeds will not interfere seriously.

*Preparing the Land for Planting.*—So far as we can judge of the habits of the plant, the yield of this crop will, like Irish potatoes and some other root crops, be largely governed by the preparation of the soil before planting. With the preparation given to many of our wheat fields before seeding we should not expect over half the crop that might be grown with good fitting of the land before planting.

We have never found large cañaigre roots in close, compact soil, and we find that it does not develop fully on our heavy soils under cultivation unless the soil is well broken and loosened up occasionally during the season of growth.



Seeds of the Cañaigre (*Rumex hymenosepalus*). Natural size.



Dried Bracts, which surround the Seeds of Cañaigre (*Rumex hymenosepalus*). Natural size.

The plant is tenacious of life; it will live under almost any conditions, but it will only produce a large yield of new growth where it finds congenial surrounding conditions. We have set forth the remarkable adaptability of the plant so fully, that we wish to emphasize the above statement so that cultivators may not be disappointed in yield obtained. We know of no crop or plant that will make a large yield without certain requirements, and cañaigre is no exception. With moisture, it will grow as a weed all through southern Arizona, but it will require certain conditions to make a large yield of roots, one of which is well prepared, deep, loose soil, if the soil is not naturally in that condition.

*Cost of Growing.*—Our experiments in growing cañaigre are on too small a scale to form a base for an estimate of cost of cultivation of large areas. We can approximate the cost very closely, however, from our experience in growing Irish potatoes, a crop which is handled in a similar way.

The ground should be well plowed, the tubers dropped and covered with the potato planter, which, with a little adjustment, will do the work. To secure the largest yield the planting should be done before the first of October and the soil moistened. The crop should be irrigated from four to six times, and some implement of the two-horse cultivator style, with narrow teeth, run through the rows after each irrigation to loosen up the soil.

The potato digger will lift the roots from out of the ground, and this may be rigged with a carrier so that the roots will be dropped on a truck wagon driven alongside, somewhat on the plan of the grain header and the accompanying wagon; and if the digger cannot be rigged to dig two rows at a time, two or more may be driven on either





*RUMEX HYMENOSEPALUS* (Caña Agria—Cañaigre).







ROOTS OF CAÑAIGRE (*Rumex hymenosepalus*). One-third natural size. This cluster is from one plant.







YELLOW DOCK (*Rumex crispus*). One-third natural size. Cut appended to show the different habit of growth and style of root from Cafiaigre.



side of the wagon used for hauling the roots from the field, the object sought being to exclude all hand labor in planting, digging, and picking up.

With the field cleared, leveled, and put in shape to be irrigated, and seed on the ground, we would estimate the cost of growing somewhat as follows:

Plowing and preparing land, per acre .....	\$3 00
Planting with machine .....	2 00
Irrigating and cultivating .....	8 00
Digging with machine .....	2 00
Water rental .....	1 50
Total .....	\$16 50

Cost of hauling roots from the field would depend on distance to factory or station. Cost of seed is not included, for, as has been stated, the seed roots planted will be harvested with the new growth and are richer in tannic acid than when planted.

This estimate is for growing fields of from 100 acres up, sufficient area to warrant the use of the necessary machinery. On plantations of 1,000 acres or more, stationary and portable tramways, with horse cars, such as are in use on the large sugar plantations in Louisiana and Texas, will be desirable to reduce cost of hauling roots from the field to the factory. With the tramway the plantations may extend several miles from the factory without making the cost of delivery prohibitive.



## RHIZOBIUS VENTRALIS.

Since the last report was made, reports have been received from most every section where colonies of the black ladybird (*Rhizobius ventralis*) were placed. Most of them herald the increase of the parasite. In some orchards thousands have been gathered this season and distributed among orchards infected by the black scale. During the months of August and September more than a thousand strong colonies were distributed throughout the State. Besides, a great number of extra large colonies, of several hundred beetles each, were placed in orchards in Los Angeles, Orange, Riverside, San Bernardino, and San Diego Counties. The Entomologist of this Board personally attended to their distribution, and the placing of colonies in the orchards. In all several million have been distributed, and all these insects are the product of about ten perfect pairs originally introduced. The introduction of this insect will prove of untold value, and a great boon to our State, for it has proved to be eminently successful. In the early part of the season many discouraging and conflicting reports were made in the papers, due to the habits of the insect being unknown.

On August 7, 1894, the following Associated Press dispatch appeared in various papers:

POMONA, August 6.—It seems that the black ladybug which was introduced in the Pomona Valley several months ago has been doing satisfactory work for the fruit growers around Pomona. A number were placed on the Mountain View ranch, owned by Col. F. P. Firey, at that time, and did good work against the black scale. In speaking with Col. J. L. Howland, he said that in looking over his ranch he found quite a number on the trees he examined.

The "Pomona Progress" of August 4, 1894, says:

There has been for over a year past such a difference of opinion and diversity of statements of facts regarding the work of the *Rhizobius ventralis*, or black ladybird, in destroying black scale, that fruit growers have not known whether to give the insects a trial in their orchards or not. The officers of the State Board of Horticulture, under whose auspices the black ladybirds were brought to the coast from Australia and propagated and distributed here, have stoutly maintained that the insect would eradicate the black scale from Southern California in time, and have already done so in one or two large orchards, notably Ellwood Cooper's large olive orchard at Santa Barbara.

Many colonies were distributed by the State Board of Horticulture throughout Southern California last fall, a dozen or two being placed in groves in this valley. As no one had been able to find any trace of the bugs after they were liberated on the trees, nearly everybody supposed they had died or disappeared and would accomplish nothing, and some papers have so stated several times. Recently Alexander Crow, Quarantine Officer of the State Board of Horticulture, with W. E. Collins, Commissioner of San Bernardino, and a local horticultural officer, inspected several orchards in Pomona. One was the olive grove of J. L. Howland, who like others had not been able to find any trace of the insects since they were put upon his trees. By spreading a white sheet under the trees and shaking the latter the officers found large numbers of the insects on the trees, and discovered on close examination that they were destroying the black scale. A visit to George F. Ferris' orchard disclosed the same state of facts, and all were convinced that the insects were propagating satisfactorily and doing the work for which they were brought to this country.

When it is considered that the first black ladybirds—a consignment of ten pairs only—were brought to this country in 1892, their propagation and work on the black scale here is encouraging. Mr. Crow says observation leads him to recommend the liberation of colonies on olive trees, leaving them to extend their range in a natural way to other sorts of trees. He finds that colonies so started thrive much better than those started

on citrus trees. In Santa Clara County he finds several colonies doing excellent work on the brown apricot scale. On the whole he has no question of the value of the insect in its effects upon the black scale, black smut, and the brown apricot scale. Already in Mr. Cooper's orchards they are saving an annual outlay of between three and five thousand dollars, besides an infinitely greater loss in preservation of the vitality of the trees and in their better fruitfulness.

Prof. T. N. Snow, Horticultural Commissioner of Santa Barbara County, in a letter to the "Santa Barbara Press" of August 26th, says:

On the 22d instant, I went to Mr. Hemenway's place (where a colony had been placed) for the fourth time this month, and from eight trees gathered more than one thousand ladybugs. From one tree I obtained two hundred and fifty in fifteen minutes, and the whole cañon was alive with them.

The following is from the "Azusa Pomotropic" of August 23d:

Interest in the success of the ladybirds, which now seem to be giving the black scale a great deal of worry, is unabated, and since Mr. Cooper's letter, which is given below, was written, similar reports of their efficiency come from various localities. Unlike the *Vedalia*, which worked efficiently under all circumstances, the *Rhizobius* seem to require shade and shelter to do good service. The new scale destroyers are being given a fair trial by officials and orchardists, and may yet prove efficacious when they become acclimated to brave the vicissitudes of heat and cold. The following is Mr. Cooper's letter written to W. R. Barbour, of Covina, advising him of efforts being made to disseminate the *Rhizobius*:

"I send you by this mail a package containing a colony of ladybirds (*Rhizobius ventralis*). A few of these beetles, probably not more than ten perfect pair, were placed in olive orchards badly infected with black scale (*Lecanium oleæ*), on May 15, 1892. In September, 1893, they had increased to many millions. The orchards at this writing are entirely free from scale insects. Over five hundred colonies were sent out last fall. Reports from some who received them are very encouraging and satisfactory, while from others no apparent benefit has been derived—statements are made that no ladybirds or their larvæ can be found.

"I have visited a number of orchards where colonies were placed, and have made this observation: That, in every case where there are good sized trees, very bushy, offering protection to the beetles, and there were plenty of scales, good work had been accomplished. The beetles and larvæ in all stages were plentiful on the surrounding trees, so that this summer the parasites will surely complete the destruction of the pests.

"In orchards where the trees were small and very open, it had not been so successful—but few beetles or larvæ could be found, and there was not much hope of success. Therefore, you will place this colony on a tree very dense in foliage, where there are plenty of scales, and no spraying or fumigating must be done in the orchard."

Edward L. Koethen, of Riverside, in an article in the "Riverside Press" of August 30th, says:

It may not be known to all our growers that during the summer of 1893 the white cottony scale gained ground so rapidly in certain orchards that for nearly three months of the year the entire force of inspectors was required to inspect and reinspect the infected orchards, to the exclusion of very much necessary work on other ranches, where the red and other scales needed the attention of the inspectors, and the appropriation was insufficient to justify the employment of more inspectors, so that at the end of the season it became apparent to our Commissioner, Mr. House, that some other policy was a necessity.

Then came the assurance of the members of the State Board of Horticulture that the *Vedalia cardinalis* could be depended on to make of the white scale a harmless enemy. This advice was reluctantly accepted as the only resource. It was some time in February that the first colony (about twelve bugs) of the *Vedalia* was placed in a tree containing quite a number of the white scale, and only a few weeks elapsed before they had multiplied sufficiently to get colonies from this tree to place in other orchards. The result is that this beautiful little ladybird has gained an established foothold in the valley, and they have been found in adjoining orchards from the ones where they were colonized, as far as a quarter of a mile from the original colony, hard at work, devouring their natural food, the cottony scale. So that the experiment now seems to be an assured success, and all the orchardist who finds white scale on his trees has to do is to apply for a colony of *Vedalia*.

As to the black scale, this is one of the most serious pests we have to contend with at this time. It has gained a firm foothold, not only on citrus, but on other trees, and would be impossible to eradicate without the aid of nature. It seems that the increased acreage of irrigated land has imparted to our atmosphere a certain amount of moisture, that has made it more like that of the coast, and hence favors the development and perpetuation of the black scale, and as our trees become larger and closer, the tendency is

likely to increase. The *Rhizobius ventralis*, another Australian ladybug, seems to be the only other source of permanent relief. It is a little black bug about the size of a black scale, having a dark brown spot on each wing, its natural food in this country being the black scale. It has already done good service in some localities in cleaning up smutty orchards, but its success has not been uniform, being erratic in its nature.

To illustrate: Mr. Barney received a colony last fall, which was placed in some Tangierine trees, where abundance of food seemed to be present, but as yet bugs have not appeared in sufficient numbers to be encouraging. On the other hand, it is only about six weeks since a colony was placed in a tree in Mr. Gilbert's orchard, and now the bugs may be seen there in all stages of development, and give promise of rapid multiplication. This is the first promise of success with this insect in Riverside, but no results can be expected for another year. In the meantime it is the policy of the Commission to advise growers to spray all trees that are sufficiently infested to smut the fruit of the next picking, the idea being that it will be cheaper to spray than to wash fruit. However, all growers should be cautious not to spray the trees near ones where colonies of *Rhizobius* have been placed.

In the "Santa Paula Chronicle" of August 24th appears the following letter:

*Editor "Chronicle":* I recently examined the orchards where the new black ladybirds are breeding, to see if the beetle had increased enough to distribute colonies, and found plenty of larvæ but not many beetles. The beetles probably spread out over the orchard as soon as they are able to fly, which will make it longer before we can collect them to advantage than I anticipated. Mr. Cooper writes me that he has just examined the orchard where I collected the ladybirds, and was astonished at the result. Ten thousand on each large tree would be a low estimate of their numbers. He will send out more colonies next month, and I advise those wanting them soon to write him for a colony.

J. F. McINTYRE,  
Horticultural Commissioner.

The following is from the "Riverside Press" of August 25th:

Professor Woodbridge of Los Angeles reports that the colony of *Rhizobius* which he located in his orchard have not only done wonders in destroying the black scale, but he is convinced are doing good work upon the red. He finds that they have bred rapidly, and thinks the trouble with colonies placed in the San Gabriel Valley is that they were moved late in the season, and the birds and the cold weather combined may have destroyed them. He is quite sanguine that this black ladybug will yet prove as efficacious as spraying or fumigating to clean our orchards, and far less expensive. We sincerely hope his views will prove correct, and advise our local orchardists to obtain colonies of this scale-eating bug, and see that the best conditions are afforded them.

At the last meeting of the State Board, President Cooper reported having visited most of the sections where colonies of the *Rhizobius* had been sent. He said that, in every instance, he had found the ladybugs, but that on trees with heavy foliage, affording shelter, they were more plentiful; that the insects had already saved growers thousands of dollars. More than a thousand colonies have been distributed, and in another year they should be found throughout the State. The investigations made by the Entomologist of this Board prove substantially the same. The insect being a new one here its habits were unknown, and while present in various stages were passed unobserved, and thus conflicting reports were made.

A few reports on the increase of the *Rhizobius ventralis* are herewith appended (although many more are on file), to show how they have multiplied in places other than where they was first colonized, as follows:

SAN BERNARDINO, CAL., September 10, 1894.

B. M. LELONG, *Secretary State Board of Horticulture:*

DEAR SIR: Last fall I received a few *Rhizobius ventralis* from Mr. Cooper, and this spring I reported to you that they had probably perished, as nothing was to be seen of them, nor was there any apparent diminution of the black scale.

I write now to amend this report in the light of further experience. I placed the insects on a large vine of *Periploca græca*, which runs over my house, and which was



very firmly packed with them. I am now unable to find any living scale on the vine. Five or six hundred feet away is a large tree of the Chilian *Maiten*, which was also badly infested with black scale, many twigs being killed and the foliage blackened with their excrement. This tree is now nearly free from scale, although they can yet be found on it in several stages of growth. The foliage is but little blackened, and there is a vigorous new growth, showing returned health. These are the only badly affected plants I had. There was a little scale on some apricots, and these still have some on. \* \* \*

Very truly yours,

SAMUEL B. PARISH.

SANTA MARIA, June 6, 1894.

B. M. LELONG, Esq.:

DEAR SIR: W. W. Stillwell got *Rhizobius* from Ellwood Cooper last October. I find they have survived the rough weather and are now at work, with some larvæ appearing. I think they will be a success.

JAMES HUSTON,  
Horticultural Commissioner.

LOS ANGELES, June 30, 1894.

B. M. LELONG, Esq.:

DEAR SIR: *Rhizobius* increasing rapidly; prosperous and happy.

E. BONTON.

LOS ANGELES, CAL., December 7, 1893.

B. M. LELONG, Secretary State Board of Horticulture:

DEAR SIR: The colony of *Rhizobius ventralis* has increased incredibly, and has almost subdued the black scale in my deciduous orchard. I am happy to report its efficiency.

Very gratefully,

R. D. LIST.

SANTA CRUZ, CAL., June 26, 1894.

Mr. B. M. LELONG:

DEAR SIR: Your kind favor at hand and noted. In reply, will say that the ladybugs sent us last year have been a great success. We have been scattering them among our neighbors, and the bugs seem to be just the thing to clean out the scale. Thanking you for past favors, etc., I am,

Yours truly,

A. G. ROSE.

SANTA BARBARA, CAL., July 17, 1894.

Mr. B. M. LELONG:

DEAR SIR: Answering your card of June 22d, as to ladybirds (*Rhizobius ventralis*) which prey on the black scale (*Lecanium oleæ*), I report:

I have but few citrus trees, and until some eighteen months since I had but little trouble with any kind of scale. During my absence of some months last winter and spring my premises were in charge of others, and on my return I found that my orange and some of my ornamental trees seemed to be alive with the black scale. The tender and small branches of some of my trees were so thickly covered with the scale that there seemed to be no room for more. I applied to Mr. Ellwood Cooper for the *Rhizobius*, and he sent me two or three colonies, which I put upon one of my trees, and after some six weeks I found *all* my trees thoroughly free of the black scale. Some of my neighbors have supplied themselves from my trees. I have made no other effort or experiment with the *Rhizobius*.

Yours truly,

E. B. HALL.

SAN DIEGO, CAL., July 25, 1894.

Mr. B. M. LELONG:

DEAR SIR: Since writing you in regard to the *Rhizobius ventralis*, I have made a further and most systematic search, and find that parasite *has* increased to a remarkable extent. The closest scrutiny is necessary for their discovery, as a great many of them appear to be much smaller than the original bugs. Another remarkable feature is that they are preying almost entirely on *A. rapax* and *M. citricola*, doing magnificent work against these pests, hardly touching the black scale. I am in hopes they will continue to multiply, and after they have cleaned out the former, will commence on *L. oleæ*.

Very truly yours,

W. R. GUNNIS,  
Horticultural Commissioner.

SAN DIEGO, CAL., July 17, 1894.

B. M. LELONG, Esq.:

DEAR SIR: I returned home after an absence of many months a few days ago and received your postal card notice. I looked my olive orchard thoroughly over and found that the ladybugs have done their work well. Nine tenths of the black scales, which were very numerous, are now dead. The trees were not disturbed by spray or otherwise after the colony of ladybugs was placed upon them last year.

The ladybugs are not as numerous in the orchard as I would like to find them. In looking over the orchard I found two dozen, but their work has been done thoroughly.

I am, yours very truly,

A. A. MULLOY.

NAPA, June 17, 1894.

Secretary State Board of Horticulture:

DEAR SIR: I received from Mr. Cooper at Santa Barbara, October 2, 1893, a colony of ladybirds (*Rhizobius ventralis*), with request that I report progress and increase of same to you. They have not apparently spread to any great extent, but have certainly increased in the immediate vicinity of the tree on which they were first placed, as I find many active larvæ at work, and the scales are certainly disappearing on a few olive trees around the original colony, though the scales are increasing alarmingly on the rest of the orchard. I find more larvæ than bugs, which I rarely see. Will watch and wait and report further progress.

Respectfully,

GEO. DUHIG.

NORTH ONTARIO, CAL., June 16, 1894.

B. M. LELONG, Esq., Secretary State Board of Horticulture:

DEAR SIR: October 6, 1893, I received a colony of twenty-five *Rhizobius ventralis* and placed them as directed. March 10, 1894, I found three full-grown *Rhizobius* in my orchard. April 23, 1894, I found at least sixty larvæ, some of which were at least forty rods from where they were originally placed. May 5th, found one half-grown bug. To-day (June 16th), I discovered one larva of the *Rhizobius* ravenously devouring black scale. I watched it through a microscope for about thirty minutes. \* \* \*

My orchard is badly infested with black scale, but I feel confident that the *Rhizobius* will clean it out in time if left alone; therefore I do not want to fumigate or spray. \* \* \*

Respectfully,

GEO. BARLOW.

SANTA BARBARA, CAL., July 2, 1894.

B. M. LELONG, Esq., San Francisco, Cal.:

DEAR SIR: Your card of June 22d, asking for a report on the *Rhizobius ventralis*, which I colonized last year, came duly to hand. On June 8, 1893, accompanied by three gentlemen, I went to Ellwood, and through the kindness of Hon. Ellwood Cooper, we were taken to his olive orchard. He showed us the ladybird and its larvæ, and we gathered about seventy specimens. In dividing I took about twenty-five, and that night I placed them in a small lime tree (five feet high and nearly as broad, with dense foliage), which was literally covered with black scale from the ground to the leaves.

In July, 1893, I went again in company with Benjamin T. Hayne, of Montecito, and we obtained about forty specimens. My portion I shared with my neighbor, Paschal Hacker, whose garden adjoins mine, and what I had left I placed on an olive tree which had but little foliage.

In the autumn Mr. Craw sent me a colony of twenty-five, which I placed on a lemon tree badly infested with black scale. The foliage was not dense, but yet quite full of leaves. For twelve months I looked for results. The lime tree became well nigh cleaned of scale and smut, it bloomed and bore good clean fruit for the first time; the bark looked as if washed with soapsuds; but I saw no sign of *Rhizobius* except once, when I found one on my hand. The olive tree and the lemon did not appear to be much if any improved. On June 8, 1894, Mr. Ellwood Cooper came to inspect my colonies. With the aid of his "hunting tackle" we found the *Rhizobius* (both beetle and larvæ) on the lime tree and the lemon, but none on the olive. In larger orange trees of dense foliage, situated at considerable distances from those on which I placed the colonies, we found both the beetles and larvæ in greater numbers. (My grounds contain  $1\frac{3}{4}$  acres, and Mr. P. Hacker's about  $1\frac{1}{4}$  acres.) These larger trees are by no means clean, although a few feet off they appear so. In fact, strangers coming into my place remark, "How clean you keep everything." But I know where the "evil ones" lie; and I live on, or in, the hope, yes, the expectation, that this summer I shall raise a million specimens of the *Rhizobius*, that will rid my garden of black scale. I have about one hundred and thirty lemon trees, twenty orange trees, a few limes, and some pepper and other ornamental trees, which are agreeable nesting-places for the black scale, and if I can breed a million beetles this year, my neighbors and others in and throughout the county shall have the benefit in the near future.

I believe the *Rhizobius* will prove a success; but trees of thin foliage will be longer in showing improvement.

Yours, very respectfully,

T. N. SNOW,  
Horticultural Commissioner.

Prof. A. J. Cook, of the Pomona College, recently of the Michigan Agricultural College, an economic entomologist of the highest repute, visited Santa Barbara and made a careful investigation of the work accomplished by the *Rhizobius ventralis*, and the following is his report, as published in the "Los Angeles Times":

While attending the Farmers' Institute at Santa Barbara last week—September 6th and 7th—I learned, through the wide-awake and competent Fruit Commissioner of Santa Barbara County, T. N. Snow, that six miles north there were citrus orchards that had been entirely freed of the black scale (*Lecanium oleæ*) by some of the last imported ladybird beetles. I arranged at once to visit these orange orchards, and early next morning, in company with Messrs. Wright, Howland, and Packard of Pomona, and Mr. Snow of Santa Barbara, proceeded first to the orchard of M. C. Hemenway, where had been introduced fifteen of the ladybird beetles last October. This orchard, which consists of orange and lemon trees, was very dirty with the fungus which always disfigures scale-infested trees, and the carcasses of old last-year scales were exceedingly abundant. Upon close examination it was found that there were almost no young scales. An occasional young black scale (*Lecanium oleæ*), and in one place several soft brown scales (*Lecanium hesperidum*) were, after long looking, discovered, while the little beetles were exceedingly abundant. Each of the party secured several hundred to take away, that they might continue the good work of devouring the blighting scale in other orchards. This was to me an exceedingly interesting object-lesson. I had read how the *Vedalia cardinalis* had cleaned out the cottony cushion scale, and here saw how even the more destructive black scale had been devoured by the later importation from Australia.

The principal agents which had been so beneficial to Mr. Hemenway proved to be *Rhizobius toowoombæ*, a small, black beetle with brown head and thorax; *Rhizobius debilis*, which is about the same size as the other, but is entirely black above and below, and the *Rhizobius ventralis*, which is larger, entirely black above, with short, light hairs and brown below. The first mentioned were much the more abundant. One half mile west of Mr. Hemenway's orchard is the citrus orchard of C. R. Hails, and between this and the other an orchard belonging to an Indian woman. Into the former five ladybirds were introduced last autumn, but into the latter none had ever been introduced. I carefully examined both orchards, and found innumerable ladybird beetles and almost no scale, though the signs of their devastating presence last season were no less apparent than in the orchard of Mr. Hemenway. On Saturday, the next day, Messrs. Howland and Packard, of Pomona, Mr. and Mrs. Thompson, of Pasadena, Dr. Woodbridge, of Los Angeles, and myself visited the 1700-acre estate of Hon. Ellwood Cooper, of Ellwood, fourteen miles northwest of Santa Barbara, where the beetles were first introduced, and where they have been watched very carefully by Mr. Cooper, to whom, more than to any one else, we are indebted for these saviors of the orchards of California. We first visited the large olive orchard where the beetles were originally introduced. Mr. Howland, himself a large olive grower at Pomona, saw this orchard two years ago. He said the transformation was most marvelous indeed. Two years ago it was filthy with the secretion of the black scale, crowded with millions of these terrible pests, and he thought utterly ruined. Now it was clean, bright, and vigorous. We could find no living scale, and only one of the little benefactors, which we found after repeated trials. It had evidently remained behind to clean up the few remaining scales, which we were unable to find.

We next visited a large walnut orchard, and here also found *Rhizobius debilis* and *R. toowoombæ* hard at work, in force, cleaning out the aphids. Mr. Cooper next took us to a fifty-acre orchard of olives, where rhizobiids were introduced last October, and which at that time was suffering fearfully from the black scale. The beetles were introduced at one end of the orchard and are now just completing their blessed work at the other end about one half mile distant. We could see the altered foliage and renewed vigor, while many rods away. Upon examination, we found the little beetles in countless multitudes, and the scales nearly gone, while at the end of the orchard where the beetles were first introduced, which I carefully examined yesterday (September 17th), there are almost no scales or beetles. To show the importance of this, Mr. Cooper tells me that he used to spend from \$3,000 to \$5,000 annually in spraying this orchard, and even then the results were far from satisfactory—not to be compared with the work of the rhizobiids. We found all the species taken in the other orchards, but the *Rhizobius ventralis* was by far the most numerous. Mr. Cooper thinks this the most effective enemy of the black scale. In two hours, the time at our disposal, we secured thousands of the beetles to take away with us. Mr. Packard said he would engage to secure a peck if he could be given three days to do it in. Indeed, Albert Koebele, to whose skill and efficiency California owes both *Vedalia* and these later-introduced benefactors, estimated that a single pair of rhizobiids could produce 15,000,000,000 in a single year. No one can visit Mr. Cooper's place and not be convinced that his estimate is a reasonable one.

Returning to Claremont I introduced the thousands of beetles I secured in the Omstead olive orchard, two miles east of Pomona; in the orange orchard of Mrs. Loomis at North Pomona, and in the olive orchard of Rev. Mr. Loop of Claremont. The insects secured from olive trees were placed on olive trees, and those taken from orange trees were put on orange trees. In every case they were put on trees with thick foliage, which were infested with black scale. I counted 189 young vigorous scales on a single olive leaf,



and in each case introduced on trees near by trees of the other kind. Thus the olive was close to orange and vice versa.

I next visited orchards where colonies of the beetles had been introduced in small numbers some months ago; among others the orchards of Messrs. G. F. Ferris and Drehr of Claremont, and of Mr. Howland of Pomona. In the two former I could find no beetles, but in the latter the beetles were present and breeding, which shows that it is not any climatic peculiarity that has destroyed them. It may be that only males or unmated females, or females that had laid all their eggs, were introduced. More likely birds or lizards had eaten them up. I suggested to the Claremont fruit growers that it would be more than wisdom to introduce many of the beetles in a single orchard, and nine gentlemen at once acted on the suggestion and engaged me to come immediately and secure more of these tiny friends. I worked in the large Cooper orchard all of one day and secured several thousand of the beetles. I shall take as many from the orange orchards before mentioned. These will be liberated in olive and orange orchards at Claremont. I found Alexander Craw, the entomologist, hard at work at Mr. Cooper's collecting and sending out the beetles. I feel certain that he had 100,000 caged ready to be distributed. These are to go to all parts of the State.

I have been a hard student of entomology for thirty years, and I am free to say that it is the wise and certain policy for this great fruit State to keep Mr. Koebele in Australia for some years in hunting and shipping to us more of these natural aids in fighting our insect foes.

Again, why will people spray or fumigate when we can get so easily the *Vedalia* and these rhizobiids? I saw an orchard in San Bernardino County in process of being fumigated only a few days since because a few cushion scales (cottony) were found on a single tree. This seems to me arrant folly, if not worse. Mrs. Cooper has a lovely flower-garden, which is a delight to all visitors who love flowers. Such lovely acacias! Once they were a prey to the white scale. Now, thanks to the *Vedalia*, they are absolutely clean. The lemons, oranges, limes, abutilons, oleanders, olives, pittosporums, habrothamnus, etc., were likewise foul with the black scale, in spite of all effort to keep them clean by spraying. Now, likewise, they, thanks to the rhizobiids, are entirely clean and thrifty. Need I say that Mrs. Cooper shares her husband's enthusiasm regarding the benefits of these ladybird beetles?

A. J. COOK.

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REPORT  
OF  
ALEXANDER CRAW,  
Quarantine Officer and Entomologist.

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# ENTOMOLOGY AND HORTICULTURAL QUARANTINE.

Report of ALEXANDER CRAW, Quarantine Officer and Entomologist.

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*To the honorable the State Board of Horticulture:*

GENTLEMEN: I herewith submit to you my report for the past six months. As formerly, all steamers and sailing vessels arriving at this port and likely to have plants or trees on board, have been inspected on arrival. When trees or plants were found infested with insects or diseases hitherto unknown in this State, they have been immediately destroyed, as, by Rule V of your amended regulations, they are prohibited from landing. This is a very important rule, as it reduces to a minimum the danger of introducing new pests. All other trees or plants have been dipped or fumigated, as set forth in Rules VIII and IX, unless when found, after careful examination, to be absolutely clean. Such plants as raphis and sago palms are uniformly free from pests on arrival, nevertheless each shipment is inspected, as the latter palm is subject to the attacks of coccids. The imports were lighter than for corresponding periods covered by my former reports. Japan, as formerly, furnished the greater portion of the stock. The other countries mentioned in my last report also contributed their quota. Shipments of trees and plants have arrived by rail from the Eastern States, also from England, Germany, France, and Belgium. The Southern Pacific Railroad Company and Wells, Fargo & Co. keep us advised of the arrival by rail of all trees and plants from outside the State. The only way that plants can now enter the State without inspection is through the mails. Most of the stock that comes through in this way are small flowering plants, such as roses, etc., so there is not so much danger to the fruit interests. Still, it is a well-known fact that some of the most destructive tree pests are sometimes found upon such plants. Mail matter can be inspected by the postal authorities on its arrival in this country when it is suspected to contain dutiable articles, and the National Government would thereby be defrauded out of a few cents or dollars customs dues. The introduction of an infested plant into a horticultural or agricultural district would mean individual loss to the residents of that section and entail a hardship upon posterity. Massachusetts has expended over \$300,000 within the past three years in an effort to stamp out the "gypsy moth," that was introduced a few years ago in a very simple manner from Europe. A few caterpillars or pupæ of this moth are liable to be introduced on mailed plants, so the Government should extend to California and other States of the Union (that so desire) the right to protect themselves against pests as they do against disease (in ordering all mail matter disinfected during the prevalence of an epidemic). The stringent quarantine regulations against insect pests and plant diseases adopted by the Cape Colony of South Africa, March, 1893, have been already referred to.

At the meeting of Northwestern fruit growers, held at Spokane, Wash., in February last, a committee from Oregon, Washington, Idaho,

and British Columbia was appointed to draft horticultural laws and quarantine regulations for their respective States. It was agreed that California's experience in this line should be taken advantage of, and similar bills be presented for adoption by the Legislatures of these States.

The colony of Western Australia in May last adopted your rules and regulations in full; the only change made was in the name of the country. Now comes South Australia with regulations that should prevent the introduction of new insect pests into that colony. There are but four rules, but they appear to cover the ground very effectively. The following is the full text:

1. That no growing plants or portions of growing plants of any kind may be introduced from any country without written consent of the Minister of Agriculture being first obtained upon a certificate given by the Director of Botanic Garden, to the effect that the plants proposed to be introduced are either novelties or such as are usually introduced by nurserymen, and that in his opinion there is no danger in importing same.

2. The importation of rooted grapevines from any country, and of fruit trees from any phylloxera-infested country, is prohibited, except that (a) trees and plants, not being grapevines, that have already been ordered, may be introduced up to June 30, 1894, upon proof being given, to the satisfaction of the proper officers, that such trees or plants were ordered prior to date of proclamation, and also that such plants, etc., shall be subjected to immersion in some insecticide, and that all boxes and packages in which such plants are introduced shall be at once destroyed by fire; (b) The Director of Botanic Garden may introduce new fruit trees and grapevine cuttings, but they shall be kept in a closed house in the Botanic Garden for twelve months at least.

3. The Director of Botanic Garden to be allowed to introduce any plants from any country not infested with phylloxera, except rooted vines.

4. All growing plants (or portions) introduced into South Australia shall be first delivered to the proper officer in Adelaide, and remain unopened in original packages until examined, and, if necessary, treated by him.

It was also decided that the utmost publicity be given the regulations by advertisement and by posters in the other colonies, as well as in South Australia.

In an editorial on "Quarantine against Injurious Insects," on page 208 of the February (1894) number of "Insect Life," published by the U. S. Department of Agriculture, Division of Entomology, occurred the following:

So far as we know, California took the lead in regard to this matter of quarantine, and if this State succeeds in making its measures in this direction effective, it will deserve the gratitude of the fruit growers of the entire country. The importance of such regulations in certain other States can hardly be overestimated, and Florida in particular needs some such quarantine law.

I quote the foregoing to show that your efforts to protect the State from new pests and diseases are looked upon favorably by other countries.

Some of the beneficial insects introduced by the efforts of your Board to prey upon the injurious scale insects that have been introduced into this State in past years, have exceeded my most sanguine expectations. The black ladybird (*Rhizobius ventralis*) will prove to be as valuable as the *Vedalia cardinalis*. From the few that Mr. Cooper established at Ellwood, in May, 1892, he has distributed nearly eight hundred colonies to different portions of the State. I have carefully noted the progress and work of this beetle, and am convinced that it will keep all scale insects of the *Lecanium* family in check. The olive orchards at Ellwood, in which were collected nearly five hundred colonies in October, 1893, are now entirely free from the black scale. The older orchards, near Mr. Cooper's house, that were colonized in October, 1893, are now free

from scale, but owing to the failure of late spring rains the black fungus still remains upon the trees, but this, too, will disappear. This ladybird represents to Mr. Cooper alone an annual saving in spraying of from \$3,000 to \$5,000.

Full instructions as to how to care for the beetles were sent with each colony; but it is grievous to note the failures of some of the recipients, who had divided up the colonies instead of placing them all upon one tree, as directed. Others had expected that the colony should have cleaned out in a few months a pest that had been increasing for years. I am positive that but few of the colonies that have been sent out will prove failures. One instance in proof of this was when I visited an orchard in Alameda County, in March, with Mr. Barry, County Commissioner. We found the larvæ fully a mile from where a colony was placed in October, 1893. In company with Messrs. Collins and Scott, I visited orchards in the vicinity of Pomona where colonies had been placed, and the owners had reported that the ladybirds had all disappeared, and found them increasing and spreading through these orchards. Of course, very few know how to look for such insects, but if they will only have a little patience their work will show. I also noticed that where colonies were placed on olive trees infested with black scale the colonization was more successful. When at Ellwood, in June last, Mr. Cooper called my attention to the fact that the *Rhizobius ventralis* also feeds upon aphids. On English walnut trees infested with *Aphis juglandicola*, the beetles and larvæ were at work on this aphid. Mr. Scott of Los Angeles also reports that he found them feeding upon the orange aphid (*Siphonophora citrifolella*) at Duarte. This is all very encouraging, as it insures the preservation of this beneficial insect to the State. Mr. Cooper had seriously considered the advisability of colonizing the black scale upon olive trees in nursery row on his place in order to furnish food for the *Rhizobius* and keep them on his property.

Another ladybird, *Rhizobius debilis*, has increased at Mr. Cooper's place since last fall, and is doing good work. This beetle is smaller than *R. ventralis* and slightly larger than *R. Toowoombæ*, and preys upon the black scale. I also found the *Vedalia cardinalis* and the *Novius Koebele* upon lemon trees that were very slightly infested with the cottony cushion scale (*Icerya purchasi*). It is remarkable how these ladybirds exist, as there has been very few cottony scales for the past two years for them to feed upon at Ellwood.

Under your instructions I visited the Kercheval orange orchard at Los Angeles, on June 25th, and investigated the condition of the steel-blue ladybird (*Orcus chalybeus*). While this beetle has spread and done fairly good work against the red scale (*Aspidiotus aurantii*), I would still advise that they be not distributed for the present. In a recent letter from Mr. Koebele (now in Queensland collecting beneficial insects for the Hawaiian Government), he informs me that he has discovered an internal chalcid parasite preying upon the red scale in that country, and that he will endeavor to introduce them into California. I have to report receipt of several small packages of ladybirds, and other beneficial insects, from Mr. Koebele, that have been liberated upon scale-infested trees.

While visiting Rivera, Los Angeles County, I discovered a very minute but very important ladybird in great numbers, feeding upon "red spiders." The orange and lemon trees showed evidence of having been



seriously infested with spiders, but at the time of my visit very few were left. I collected colonies of the larvæ, pupæ, and beetles for colonization in other districts. The perfect beetle is only one and one fourth millimeters in length, jet black, but sparingly covered with short silvery hairs on the elytræ and thorax. They are very timid and drop with the slightest disturbance of the leaf on which they are searching for spiders. Like other species of coccinellidæ, the larvæ are the most voracious, and not so timid as the perfect beetle.

From the coast counties south to San Luis Obispo and north to Mendocino, also from the counties adjacent to the bay and bordering the lower Sacramento and San Joaquin Rivers, we have received numerous specimens of a destructive little beetle, *Phleosinus dentatus*. The female beetle burrows through the bark of the Monterey cypress (*Cupressus macrocarpa*) and cuts a vertical channel through the sap-wood five inches in length and one sixteenth of an inch in width, along each side of which and next to the bark the female cuts a small notch, into each of which she deposits an egg; each burrow contains an average of one hundred eggs. As soon as the larvæ hatch they cut a burrow at right angles from the parent channel. When numerous the death of the tree is certain, as the sap-wood and bark are destroyed. The beetles frequently burrow into the young branches and twigs, causing them to die or break off. Like other borers, this is a difficult one to fight, as it is impossible to reach them with the ordinary washes. As a spray I would advise the use of Paris green, one pound to two hundred gallons of water. In a barrel dissolve six pounds of fresh lime in ten gallons of water, and after the lime has settled add the water to the Paris green solution; keep the solution constantly stirred, and apply to the foliage and trunk with a fine spray. The use of a repellant wash would also be useful in preventing attack. One thorough spraying with whale-oil soap, one pound to five gallons of water, in the spring, will keep the beetles away and prevent injury to a valuable specimen of this popular evergreen.

A small black beetle with red legs (*Blapstinus rufipes*) was reported by County Commissioner Motheral of Hanford, on May 3d, as seriously damaging the grapevines in San Joaquin Valley. They work at night. He found a spray of one pound of Paris green to one hundred and fifty gallons of water to be effective. His observations convinced him that they delighted in a dry soil to burrow in during the day, and that after a thorough irrigation they were not so troublesome. I also received specimens of this beetle from Los Angeles and Riverside Counties.

Another black beetle, but larger (*Eleodes quadricollis*), was also reported by him, but the same treatment answered as a check to it.

Mr. John Scott, County Commissioner of Los Angeles, made a most opportune find in his county last February. This was a new and very serious scale pest, *Pollinia costæ*, of the olive. It is a small light-colored scale that clusters in thick patches over the large branches and twigs of the olive. From the appearance of the specimens sent me I consider this the most serious pest that could possibly be disseminated through the olive orchards of the State. The trees upon which it was found were purchased in Italy six years ago, and in that time were so seriously affected that but few leaves remained and the trees made little or no new growth. The twigs were covered with fungus, under which the scales congregated. The trees were cut down and the branches burned. A

close watch will be kept to see that it has not spread. A careful examination should be made of all olive trees that have been introduced from Europe, to see that they are not infested with this scale. The spread of this pest at a time when we have a good prospect of having perfectly clean olive trees in the near future by the good work of the *Rhizobius ventralis*, would be an event to be deplored.

Some time ago the Experiment Station near Pomona received a collection of Turkish date palms from the U. S. Department of Agriculture at Washington, D. C. Recently Mr. S. A. Pease, one of the local inspectors of San Bernardino County, submitted to me for determination portions of leaves from those date palms that were very badly infested with scale insects (*Parlatoria proteus*, Curtis). This scale is not found in other portions of the State, but as the trees are new varieties of a valuable fruit and introduced for experimental purposes, I directed that they be thoroughly fumigated with hydrocyanic acid gas. In Europe this scale also attacks peach and other deciduous trees. The trees will be frequently inspected, and if necessary again fumigated.

In March, samples of pear leaves were sent me from Shasta County, that had the appearance of having been attacked by a fungous growth. A careful microscopic examination showed that the rough blister blotches were galls, and in the center of each was a small opening, through which could be seen microscopic mites. I saw we had a new pest, and determined it to be the "pear-leaf blister mite" (*Phytoptus pyri*). I immediately entered into correspondence with orchardists in different parts of the State, and received infested pear leaves from Solano, Yolo, Sacramento, Yuba, Sutter, Butte, Placer, Modoc, San Benito, and Sonoma Counties. Specimens were also sent me by Mr. M. J. Wessels, Horticultural Commissioner, of Lewiston, Idaho, with the statement that it made its appearance in Idaho three years ago. A request was received from Mr. George I. Sargent, Secretary of the State Board of Horticulture, of Oregon, for samples of infested pear leaves, which, after a thorough disinfection by submitting them to the fumes of cyanide of potassium, I forwarded to him. He wrote to the pear growers of his State and received infested leaves from different fruit sections, that showed the existence of the pest there. This pest is of European origin, and was first referred to by Scheuten, a German, in 1857. It is common in Germany, France, and England. It is also found in Australia. Within the past few years it has demanded attention from pear growers in the Eastern States, and in 1891 it was widespread and serious throughout Canada.

M. V. Slingerland, Assistant Professor of Entomology at Cornell University, Ithaca, New York, in their Bulletin 61, gives an interesting account of experiments conducted to check this pest in 1893. He found that kerosene emulsion diluted with from three to eight parts water, and sprayed on the infested trees before the leaves start in the spring, was very effective. With the strongest solutions the trees were practically free from this pest, and those sprayed with the solution diluted with eight parts water showed very few galls, not more than 1 per cent of the galls that were on the trees the preceding year. As the mites live within the galls during the growing season liquid remedies are of little avail.

Here in the warm, dry climate of California the most effective check to red spider and other mites is a liberal application of dry sulphur, as soon as the leaves start in the spring, with a second or third treatment



during the spring and early summer. As there is an opening in each gall of the pear-leaf blister mite, the sulphur fumes will enter more readily than will a solution, so I advised the use of this in each instance for summer treatment. With the Ditzler attachments to a broadcast seeder for distributing the sulphur, seventy-five to one hundred acres of orchard can be treated in one day. As nearly all the pear stocks used for budding or grafting in the State and in the East are imported from France, I have no doubt but that this pest has been brought in that way.

The "pear-leaf blister mite" is invisible to the unaided eye, and even with an ordinary pocket lens it is difficult to detect them, so that in studying this pest a powerful microscope is required. In a badly infested leaf it is estimated that one thousand mites will be at work within the tissues. The effect of their attacks is to injure the vitality of the tree and cause the leaves of the tree to drop prematurely. This mite is closely related to the "rust mite" of the orange, that produces the russet color of oranges in portions of Florida. It differs from the red spider and most other mites in having but two pairs of legs. In the case of the spider they have three pairs when young and four pairs when matured. In the *Phytoptus* the four legs are near the head, and in traveling the body is dragged along. They are light in color and cylindrical in form.

I visited several orange orchards near Rivera, where the trees were treated with hydrocyanic acid gas last fall and winter, for the destruction of the Florida "purple scale," referred to in my last report. Some of the most seriously infested trees were cut back and the stems and branches scrubbed, and the adjoining trees were treated with the gas. Most of the infested orchards had a second treatment of gas. The result is that after a day's search I failed to find a single live "purple scale," or any that had eggs. Neither could I find any young upon the small fruit or current year's growth in the orchards visited. The work will be carefully followed up and it is hoped that this pest will be stamped out of Los Angeles, Orange, and San Diego Counties, where it had gained a foothold. Where the trees were treated with C. P. cyanide of potassium the result was very satisfactory. One treatment is generally sufficient, and no scorching of the leaves was noticeable. One third less in weight should be used of this grade, so there is very little difference in the cost of fumigation. The saving in freight is considerable. The cause of occasional failure with the 58 per cent cyanide—even from the same package or barrel—was undoubtedly caused by the unevenness of the crystals. Certain chemicals having an affinity would undoubtedly be attracted to each other before solidifying. In the C. P. 98 per cent grade, the cyanide is uniform.

Judge Ross, in the United States Circuit Court at Los Angeles, on April 9th, rendered a very important decision against the validity of the patent granted for the process of fumigating trees or plants in the absence of light. A suit was commenced by the patentees against certain orange growers for the infringement of the letters patent, for an accounting of the profits alleged to have been realized by the defendants, and for an injunction against further infringement. The defendants demurred to the allegations in the complaint. In sustaining the demurrer, Judge Ross, after reviewing the case and the specifications of the patent, said: "An old process does not become a new and patentable one by being used at night instead of in the daytime, or at any particular time or in any



particular state of weather, or because better results are obtained by its use at one time than another." A number of growers have refrained from using the gas because of the threat of suit for an accounting of profits alleged to have been realized by the use of the gas process. Under this decision orchardists having "red scale" can now fumigate instead of spraying their trees, as this is the only process that will kill the scale located upon the fruit. The improved fumigating apparatus can also be constructed at greatly reduced cost from the old styles, so that the most serious objections to the use of this remedy are removed.

Complaints have been received from different sections of the San Joaquin Valley, of injury caused by the "red spider" and "yellow mite," more especially to prune trees. This has been a favorable season for the increase of these pests. The dry sulphur treatment is the only satisfactory method of checking them, and if growers would only attend to this work early in the season there would be no cause for complaint. After the spiders have damaged the leaves nothing will restore their vitality.

Respectfully submitted.

ALEXANDER CRAW.

AUGUST 15, 1894.



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EXHIBIT AT MIDWINTER FAIR

AND

HORTICULTURAL DAY TREE.

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## EXHIBIT AT MIDWINTER FAIR.

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The horticultural and entomological exhibit of the State Board of Horticulture at the Midwinter Exposition was probably the most instructive exhibit at the fair. There was displayed most every variety of fruit grown in our State, properly classified, as also the beneficial and injurious insects, both native and imported, and also samples of leaves and trees, upon which were shown the effects of insects and of various diseases from abroad, thus far unknown on this coast and taken from quarantined stock. In speaking of the exhibit the "San Francisco Chronicle," of February 18, 1894, says:

In the gallery of the Horticultural Building at the Midwinter Fair, an exhibit is installed which from both an educational and a spectacular point of view is second to none within the grounds. It is that of the State Board of Horticulture. The exhibit occupies a conspicuous place in the gallery bordering the space under the dome. It is a complete technical illustration of the horticultural industry of the State, and in addition contains the finest entomological collection in America. It is the latter which will be most popular with the public. Besides the interest that attaches to the aggregation of insects and the rarity of such collections, the beauty of this part of the exhibit will appeal to the visitor very forcibly. The collection for the most part belongs to the Board; but Professor Albert Koebele's collection constitutes a part of it. It occupies 280 square feet of room in showcases, though only the more interesting part of the Board's collection will find room in it. There are 9,000 named species of insects, among them 800 varieties of butterflies. The world, from the emerald meadows of Cashmere to the summit of the Sierra Nevada, has contributed to perfect this butterfly collection. It is something that one can spend hours over with pleasure. From the ordinary sagebrush butterfly to the noblest specimens of the order, showcase after showcase is filled with the rich-colored airy voyagers. Among the largest and by far the most beautiful of the butterflies is a specimen from Brazil. Its colors are jet black and Nile green, and on the edge of its wing it has hair. It is said that but six specimens have ever been secured. Those who have not chased butterflies in their leisure hours will be surprised to find what California has to show in that line. Some of the butterflies peculiar to the coast, as far south as Mexico, are for size and color among the finest. The caterpillars of many varieties, both of butterfly and moth, are shown. There are specimens of South American moths, in size and beauty nearly equal to the finest of the butterflies. The educational advantages of the exhibit will be of great benefit to school teachers who have entomology in the curriculum of their schools, and to the vine grower who is troubled with caterpillars and scale. They will find everything there in the insect line from the gall fly, scarcely discernible with the unaided eye, to a grasshopper five inches in length and a moth four inches across the wings. There is also a fine collection of beetles, including the mammoth sacred beetle of Egypt. One thing that impresses the inspector without an entomological education is that fifty specimens of what seem to be exactly the same kind of butterfly not only differ, but are of entirely different varieties. An effort has been made to show specimens of everything in the horticultural line grown in the State.

All the showcases and counters used at the Midwinter Fair were so made that when the fair closed they were placed in position in the rooms of the State Board of Horticulture, and are filled with rare and valuable specimens pertaining to our work. The fruits in jars also form part of the exhibit, as do the fruits which were prepared in our own experimental cellars. (See illustrations showing rooms, experimental cellar, etc.)

## CELEBRATION OF HORTICULTURAL DAY.

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On June 8th, "Horticultural Day" was observed at the Midwinter Exposition, under the auspices of the State Board of Horticulture. At one o'clock the State and County Commissioners to the Exposition, Superintendents of Exhibits, and friends assembled at the San Mateo Building, and from there marched, paying their respects to all the county buildings along the line. At the west side of the Fine Arts Building they halted and faced the building for the purpose of planting a tree in commemoration of the day.

### HORTICULTURAL DAY TREE.

B. M. LELONG (Secretary of the State Board of Horticulture): Ladies and Gentleman, Fellow Citizens: This day has been set apart by the management that we, the lovers of horticulture, may meet and by proper observance commemorate the day by planting on these grounds a tree that shall mark a special era in the history of this fair, and which is to remain after this great Exposition closes and our labors as Commissioners and Superintendents of Exhibits are over. We shall therefore plant this tree—an olive tree—an offspring from the famous historic trees at San Diego, over a century old, from which dates the first period in the horticultural history of our State, and from which trees sprang an industry of great commercial importance to our State.

In 1767 the Jesuits were driven from the missions in Lower California, and everything they had was turned over to the Franciscan monks. Junipero Serra was selected as the President of the missions, and set out for his field of labor. The Dominicans clamoring for a share in the mission work, a division was made, and in 1769 the Franciscans started northward, entering upon and occupying what is now the State of California. José de Galvez, Visitor-General and secular head, representing the King, with Father Serra, proceeded to make arrangements for the establishment of new settlements. Galvez seems to have been far-seeing, for in the manifests of the vessel sent it is found that he had caused to be shipped to Alta California, flower, vegetable, and fruit seeds for garden and orchard, and grain for the field. Twenty-one missions were established, all but three of which had gardens and orchards.

Thus, in the very early days, we find introduced the olive, the fig, and the grape. The trees were grown chiefly from seed, and were probably all, or nearly all, seedlings. Of these, there are three that have been perpetuated, namely, the Mission olive, the Mission grape, and the black fig, now designated as the Mission fig. In 1792 there were growing near the Mission San José, apples, pears, apricots, peaches, and figs; and at San Buenaventura, in addition to these, oranges, limes, grapes, olives, and pomegranates. At this time there were in the several missions about five thousand bearing trees. This was, of course, a very small number, but these trees played an important part in the horticultural



advancement of the State. They showed the possibilities in fruit culture; and furnished seeds, stock, and cions, and from the vineyard, grape cuttings, for many orchards and vineyards.

Fruit culture in early days in California was incidental. That it would ever become the chief industry of a great commonwealth was not then dreamed possible. The Franciscan fathers when they brought a few seeds with them, did so in order that they might have some of the fruits they had enjoyed in their native land for their own tables, not for the purpose of cultivating orchards for the benefit of others, or for producing fruit for sale. Their efforts were devoted to the building up of their missions, increasing the number of their adherents, and enlarging the herds in which the wealth of their missions lay.

Ladies and gentlemen, I thank you for your attention, and now take pleasure in introducing to you a most distinguished lady, Miss Nellie Boyd, who will read a poem especially prepared for this occasion.

MISS NELLIE BOYD:

If you'll turn back in history's pages,  
And likewise backward turn your vision,  
To those dear and dim and distant ages  
Of holy padres and their mission,  
I shall try to tell you briefly  
Of the reason why we chiefly  
Have the olive tree selected  
And why it ever be protected.  
Long ago from ancient Spain  
Sailed the fathers good and kind,  
For this land not touched by culture,  
Hoping here a field to find  
Where to teach and where to labor.  
Knowing well the olive's value,  
They with wisdom and with forethought  
Brought to this shore on their ships  
Olive seeds and olive slips.  
They were planted 'round the Mission  
To the solemn pealing of the bell  
And the gentle murmur of the ocean's swell.  
Long since have the fathers turned to clay;  
Yet some trees do stand to-day  
As a living monument  
For their lives so godly spent.  
From those trees there by the bay,  
We will plant a slip to-day.  
May, like its prototype, it be  
Of this Fair a memory,  
Ever lasting and ever green.

Miss Boyd received an ovation at the conclusion of the reading of the poem. Her voice throughout never faltered and every word was heard distinctly by all present.

MR. LELONG: I now take pleasure in introducing to you Mr. Frank Wiggins, Superintendent of the Southern California Building, and Mr. Frank H. Buck, Superintendent of the Northern and Central California Building, who will superintend the planting of the tree, assisted by Mr. John McLaren, Superintendent of Golden Gate Park, and his assistants.

MR. BUCK: Ladies and Gentlemen, it affords me much pleasure to assist the State Board of Horticulture in carrying out these exercises. This is a beautiful lesson; it will do us all much good and be of much benefit to our children, for there is but one sentiment among us all, and that is that we are all working for the interests and advancement of our State. (Applause.)

MR. WIGGINS: Ladies and Gentlemen, Mr. Buck has voiced my sentiments. (Applause.)

The tree was then lowered by Mr. McLaren's assistants, and each passing visitor threw in some soil, until the roots became completely covered.

MR. LELONG: Ladies and Gentlemen, it affords me much pleasure to introduce to you the oldest Commissioner to this Exposition, Col. B. B. Jackson, of Yreka.

As Colonel Jackson approached, two banners, "San Diego" and "Siskiyou," that were carried in the procession tied together, were placed over the tree.

COLONEL JACKSON: Ladies and Gentlemen, I have been asked to say a word or two on this memorable occasion, because, as Mr. Lelong said, I am the oldest Commissioner to the fair. I have, thank God, lived to see the great advancement of our great State, and if my good health means anything for the claims made for California—I am eighty-six years old, and I doubt if there are many who to-day are younger in spirit—there is no better place to live in. The banners you see here tied together and held over this tree—Siskiyou and San Diego—show that united we are Californians, and that we have but one object in view—the prosperity of our Golden State. I join with you all in wishing that this tree may live, and that we may all live to see the fruits of our labors. (Applause.)

MR. LELONG: The tree is now planted; it is proposed we give three cheers for this day, and that the tree may live.

They were given with a whoop and the procession moved on to the Horticultural Building, where the exercises pertaining to "Horticultural Day" were held.

#### HORTICULTURAL DAY EXERCISES.

MR. LELONG: As Chairman of the Committee on Arrangements I have the distinguished honor of calling this vast assemblage to order. This is Horticultural Day, a day set apart for its observance. In the parade Mrs. George H. Flournoy, of Tehama County, and Mrs. J. A. Brown, of Riverside County, carried these bouquets [pointing], grown in their respective counties, and placed on this stand by them, which, with the two banners, Siskiyou and San Diego, carried tied together, illustrate the one prevailing sentiment of unity existing among the Commissioners and Superintendents of Exhibits from the different counties to this Midwinter Exposition, which I hope will continue inseparable. (Applause.) It affords me great pleasure to introduce to you the President of the Day, Hon. L. W. Buck.

MR. BUCK: Ladies and Gentlemen, I have been called upon somewhat unexpectedly to preside at this meeting to-day, and I must therefore beg your indulgence for the brief remarks that I may make. I can assure you it is an honor which I appreciate to be called upon on this Horticultural Day. From the number of people present I am more than ever impressed with the importance of our calling, the oldest in the history of man, and originating in paradise itself for his punishment; the greatest blessing of our primeval parents was that they should work in the soil, and then Adam delved and Eve spun. The interest of the ladies in the success of horticulture, and certainly in bringing this



MISSION OLIVE TREE. From the famous historic trees at San Diego, over a century old, from which dates the first period in the horticultural history of California. Planted at the west side of the Fine Arts Building, Midwinter Fair, Golden Gate Park, June 8, 1894.





about, is evidenced by the ladies present who are wearing the horticultural badge to-day. The labors of our ladies are no longer confined to the nursery, but have taken a wider scope and extend to the field, the garden, and the orchard. Some of the most successful of our California horticulturists to-day are ladies, and I think that there has been a great improvement in the quality of the fruit since they went into the business. (Applause.)

You know ladies always had a longing for fine fruit—that is what got us into trouble in the first place. But as woman has stood shoulder to shoulder with us in our toils and troubles, we will overlook the apple episode and acknowledge her equal rights to grow as good fruit as any one.

As the present celebration is under the auspices of the State Board of Horticulture, a brief review of the work of that organization may not be out of place on this occasion. Fruit was introduced into California by the mission fathers as early as 1769, but no attention was paid to it; like Topsy, it "was left to grow." When the gold fever broke out and the American influx occurred, some of the pioneers brought with them seeds and cuttings of Eastern fruits, but it was not dreamed that the industry would ever become permanent. The peculiarities of California soil, however, and especially her climate, soon demonstrated that fruit would do better here than elsewhere in the Union. When Horace Greeley visited us in 1858 he predicted that California would some day become the orchard of the nation. How well his predictions have been realized! Fruit growing was a matter of small importance then. We had our home market, and that was all. We produced the largest, juiciest, and most highly flavored peaches, pears, plums, and apricots, and consumed them at home. We knew all about their good qualities, and so we wrote to our Eastern friends and told them. But our fruits were unknown to the world; there were over two thousand miles of mountain, desert, and forest countries between us and the rest of creation, and we could not hope to ship our products to them.

The driving of the last spike in the Central Pacific Railroad, in 1869, however, changed all that. At that time the fruit industry of the State, as a commercial enterprise, may be said to have had its birth. It was not a thrifty youngster for many years. Freights were exorbitantly high, transportation slow, and few samples of fruit found their way to the Eastern market. But those few opened the eyes of the Eastern people, and a demand sprung up for the fruit. Freights were lowered and the orchard business grew, until to-day it is the most prominent industry in the State. There is now more money invested in it, and more men employed in it, than in any other industry in California.

A business of such growing importance needed legislative encouragement. All sorts of stock were brought into the State. Pests and diseases of various kinds found a footing here, and the industry was seriously threatened. The viticulturists had organized for their protection and they were doing good work, and the fruit growers turned to them for protection to their business. In compliance with their demands a branch was added to the viticultural division, and in course of time it became the horticultural department. This answered for a time, but was after all but a make-shift. Soon it was found that the new department was inadequate and had outgrown the original. It was then that horti-

culture cut loose from viticulture, and in 1881 the State Board of Horticulture was organized.

The Organic Act provided for dividing the State into seven horticultural districts, each of them entitled to one Commissioner, and in addition, there were two Commissioners for the State at large. Their duties were, so far, to prevent the spread of contagious diseases among fruit trees and to prevent and extirpate fruit pests, and to make regulations enabling them to perform these duties in the State. A County Board of Horticultural Commissioners was provided for, acting with the State Board, the territory subdivided into districts, each one of which was under local inspectors, whose duty it was to visit all orchards and see that no pests or diseases were allowed to obtain a foothold.

I shall not take up your time in giving details of the amount of work done by these officers. Many of the Eastern States have been visited by diseases and pests; they have the yellows in the peach districts and the curculio in the plum regions. California is so far free from the influence of these pests.

One piece of work done by this Board is familiar to us all: that is, the destruction of the cottony cushion scale by the *Vedalia cardinalis*. It is but a decade ago when the orange industry seemed doomed to destruction; there seemed absolutely no hope for it. But, on a suggestion made by a gentleman now connected with this department, that inasmuch as this scale was not considered a pest in its native land, there must be a parasite working on it there, and that the parasite should be looked for. As the agent of Hon. Frank McCoppin, Professor Albert Koebele was sent to discover it, and the result was the little ladybird, which soon delivered our most important industry from absolute ruin to a remarkable prosperity. We now ship over seven thousand carloads of oranges annually, while, had it not been for the *Vedalia*, we could not ship any. Had this Board accomplished nothing else, that one act would compensate for all its labors. Later importations have done equally as valuable work, especially the *Rhizobius ventralis*.

There is not a shipment of trees or plants from foreign lands or from other States to California that does not undergo careful inspection before it is admitted, and, my friends, you who do not know the workings of the Board, are not aware of the dangers which our largest industry has escaped through these conscientious labors. There is no steamer arriving in this port from China, Japan, and the Islands which does not bring some new and threatening pests, and these all find their way to the bottom of the bay and are never heard of.

But it is not in its protective measures alone that the Board has done its work. In its experimental department much excellent labor has been done, and here I want to give credit to our Secretary, Mr. Lelong, for his careful experiments and valuable discoveries. A little anecdote will illustrate the work. Mr. Lelong had experimented in curing figs. Some time afterwards he came across some nice fruit, packed by a gentleman in the South. He wrote to inquire his process, and was informed that it was that published by the State Board of Horticulture. It was his own process (Lelong's). Experiments have been conducted in budding, grafting, cultivating, fertilizing, packing, and, in fact, in all the departments of the fruit business, and these have been published in the reports and bulletins of the Board and distributed among our fruit growers.



Another feature is the annual convention of fruit growers, held under the auspices of this Board, at which the leading horticulturists of the State meet each other and interchange ideas and methods. These all have had a tendency to build up horticulture, to improve our methods, and have made the industry what it is: the one great industry of our State of California, the orchard of America; and, my friends, I can say knowingly, that it is largely due to the labors of the State Board of Horticulture that California in the past twenty years has advanced to the front line—from a point of insignificance to one of prime importance.

We have, to-day, over half a million acres in the State, and are shipping fruit, not by the package or carload, but by the trainload. If I had been able, I would have given some statistics in regard to the shipment of fruit in some of the past years. I will state—and it is not because I belong to Solano County that I state it, but because it is the place I know of—in the year 1892, the Bank of Vacaville, which only represents a very small territory, shipped about one million dollars' worth of fruit. There have already been shipped from Vacaville this year about forty carloads of fruit, much of which has been sold at very good prices, and returns received back for it. I only speak of it because it is the point I know of, and if I had had more time I would have obtained statistics from other points. California sends out whole trainloads of walnuts, oranges, raisins, and deciduous fruits. A special freight service handles our products in millions of pounds. This season will see an output of nearly 40,000,000 pounds of prunes, 60,000,000 pounds of raisins, and equally large in other lines. The industry is still growing, and for its protection we are under the careful guardianship of the State Board of Horticulture and its numerous agents now in all parts of the State. We owe much of the success of this branch to the fostering care of our legislators, and much more to the faithful labors of the State Board and its officers. (Applause.)

Addresses were made by Mr. M. H. de Young, the Director-General, Hon. Morris M. Estee, Gen. N. P. Chipman, Gen. W. H. L. Barnes, Prof. Emory E. Smith, and others, to whom this Board is indebted for their courteous aid, as well as to all who assisted in the celebration.



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VIEWS SHOWING.

THE

OFFICES OF STATE BOARD OF HORTICULTURE

IN ALL ITS

DEPARTMENTS.

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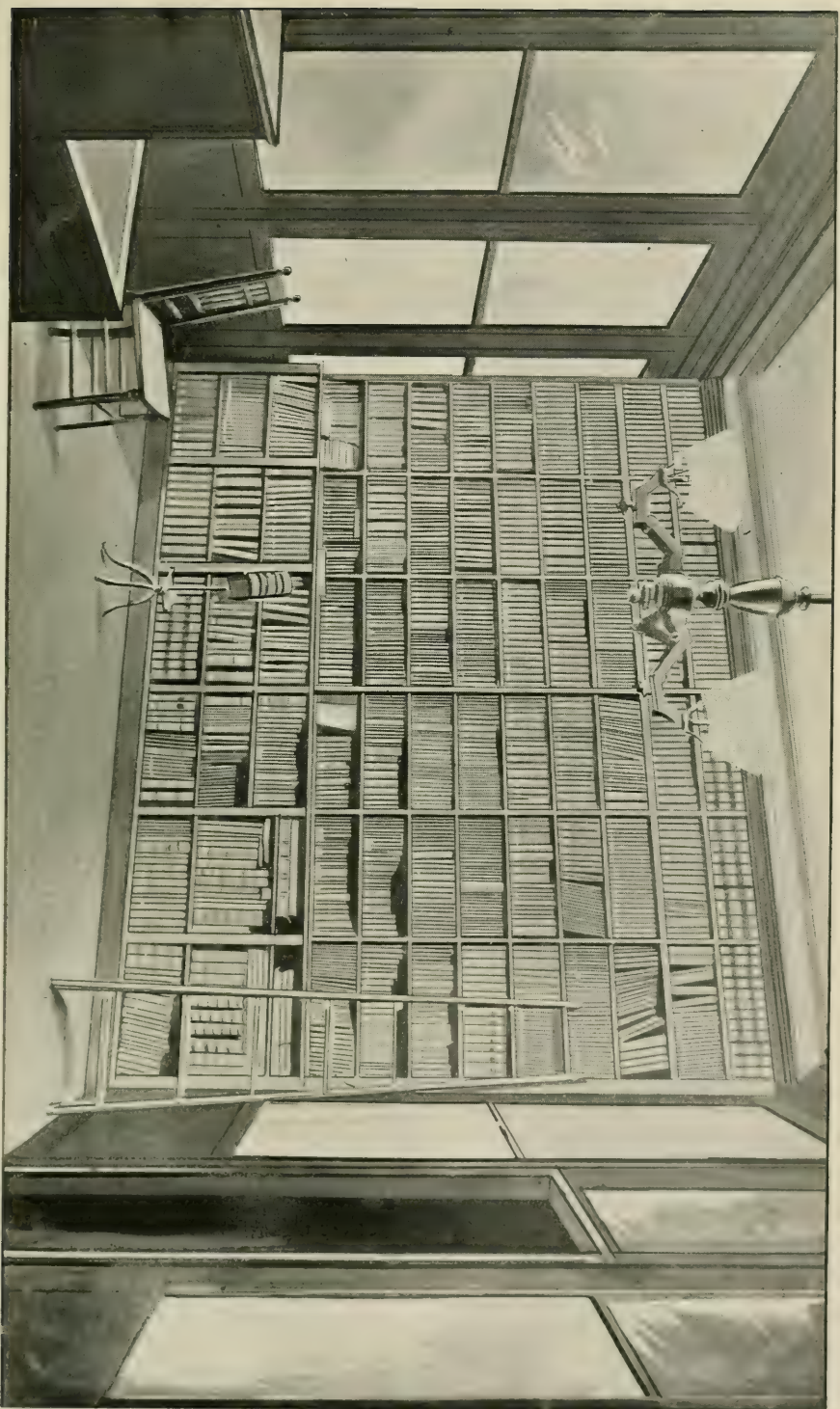






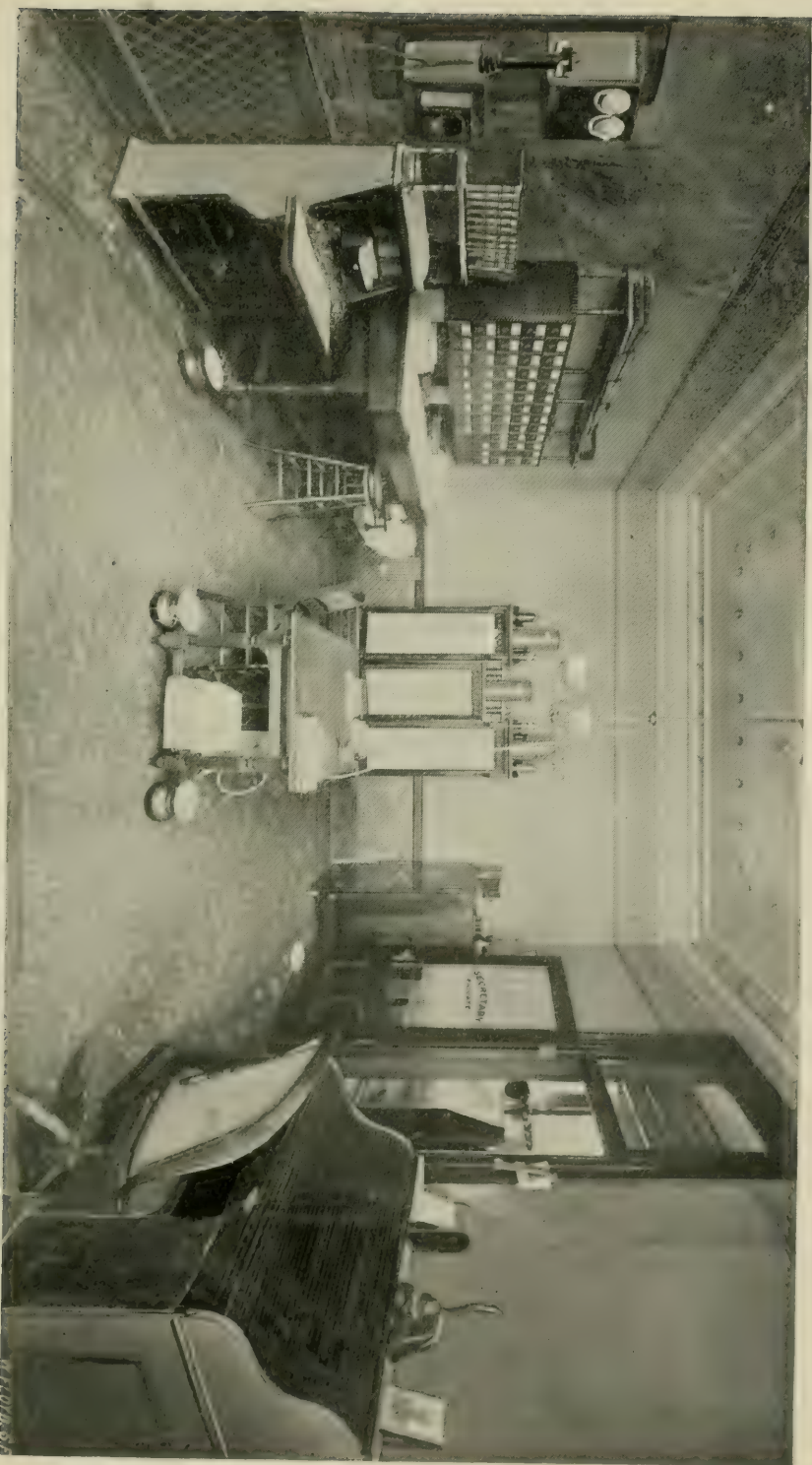






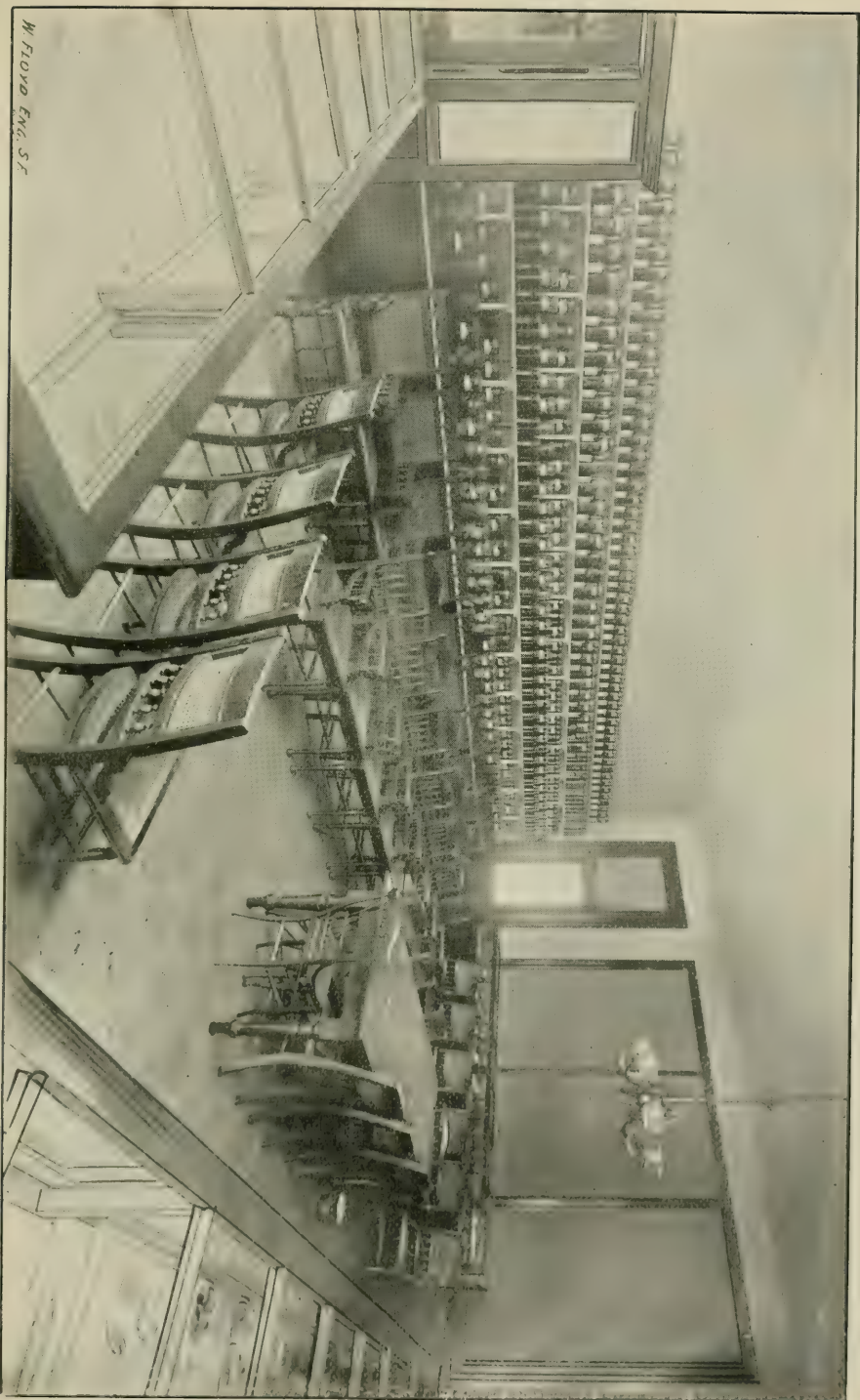
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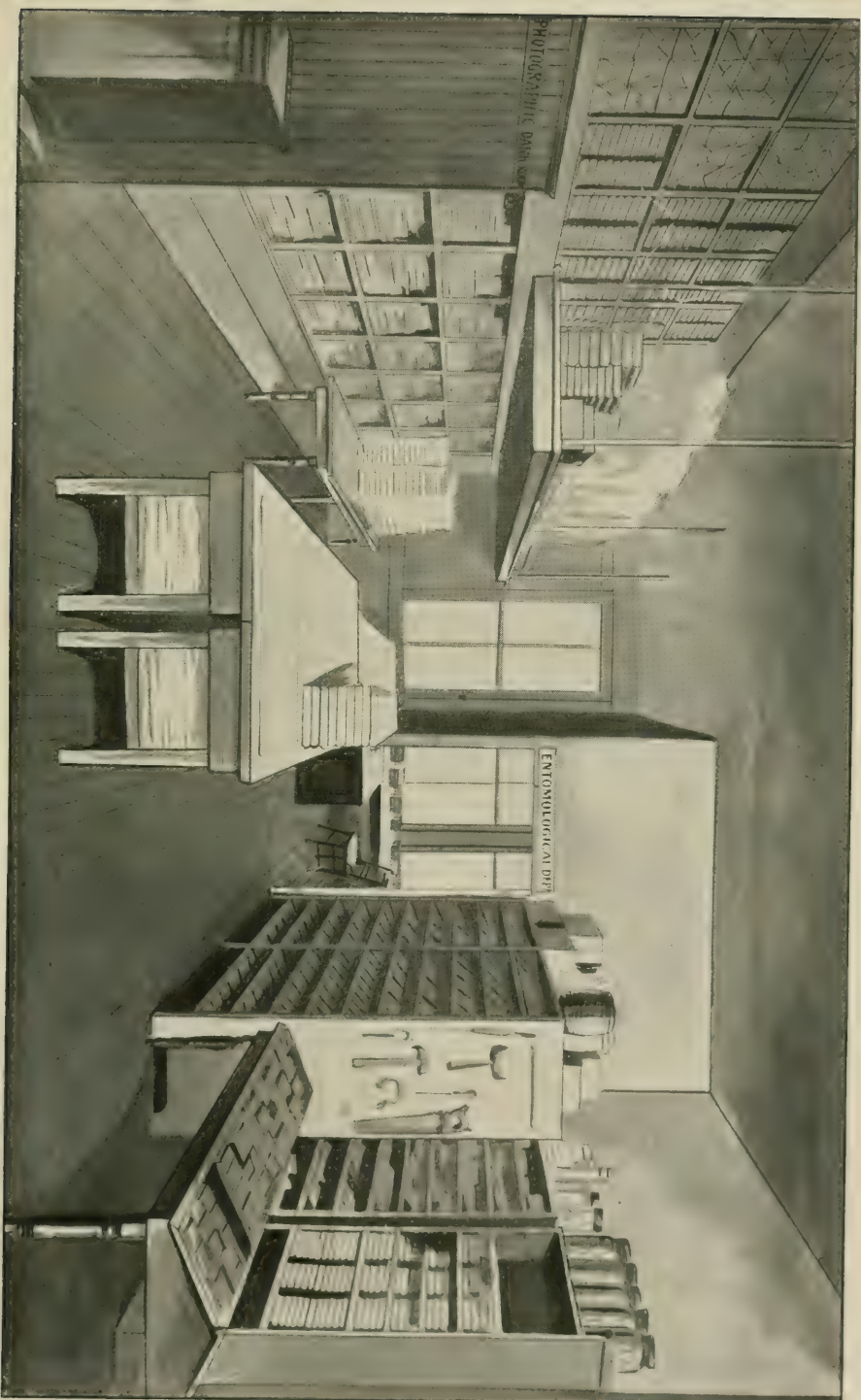








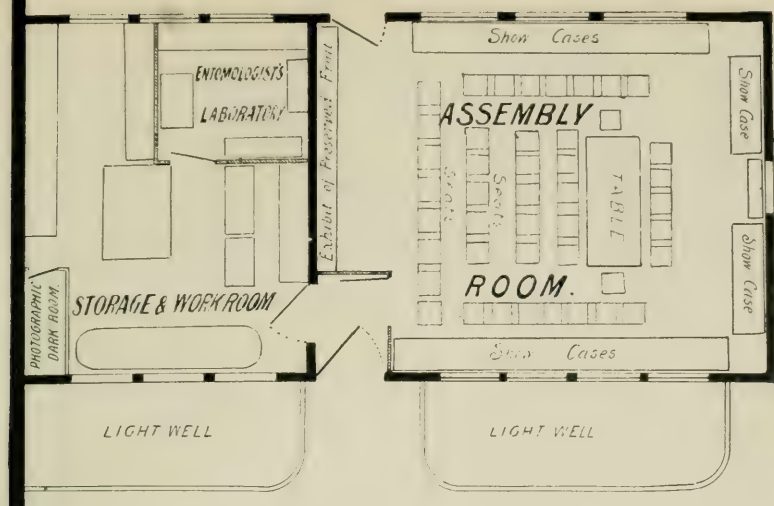






HALLWAY

To Stairs ↗



HALLWAY

To Elevator ↘

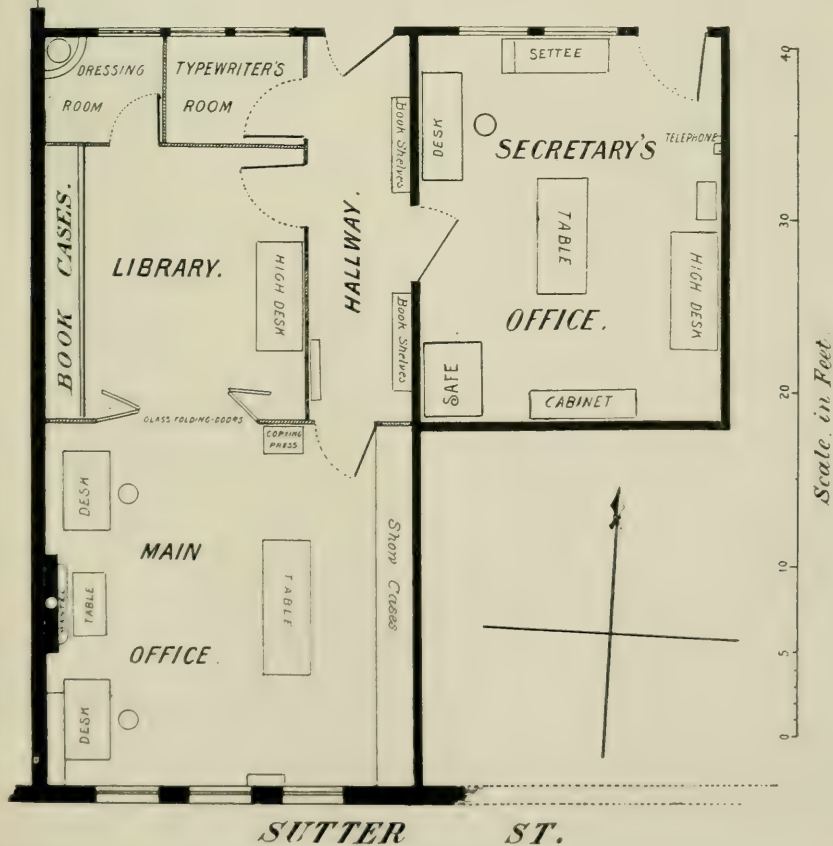
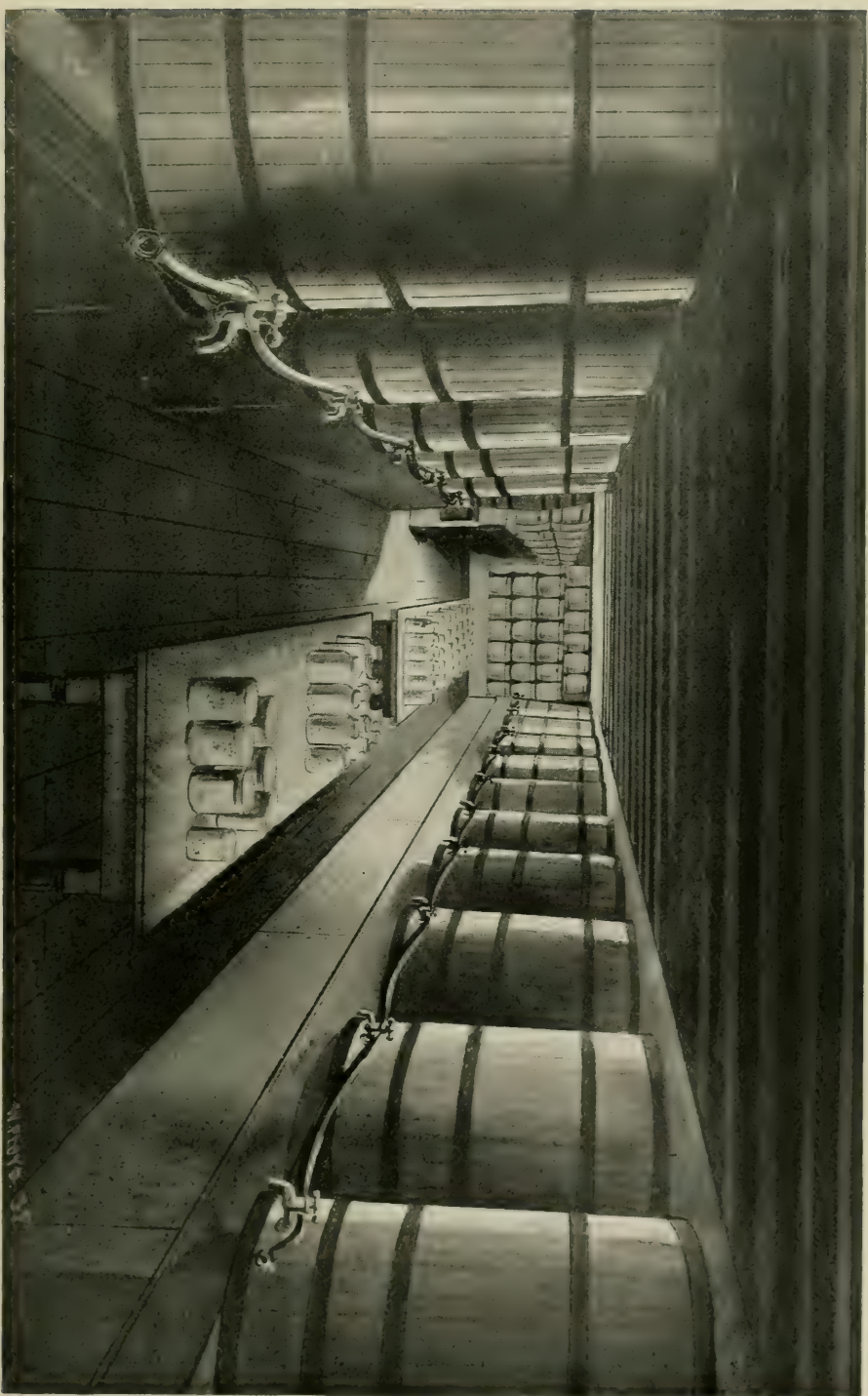


DIAGRAM SHOWING LOCATION OF THE VARIOUS DEPARTMENTS.











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# REPORT

OF THE

## Board of State Viticultural Commissioners

FOR 1893-94.

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WITH APPENDICES A, B, C, D, E, AND F (A AND B BOUND SEPARATELY).



SACRAMENTO:

STATE OFFICE, : : : A. J. JOHNSTON, SUPT. STATE PRINTING.

1894.

## OFFICERS AND MEMBERS OF THE BOARD.

---

JOHN T. DOYLE, President.....	San Francisco.
Commissioner for the State at Large.	
E. C. BICHOWSKY, Vice-President.....	San Gabriel.
Commissioner for the Los Angeles District.	
H. W. CRABB, Treasurer.....	Oakville.
Commissioner for the Napa District.	
J. DEBARTH SHORB.....	San Gabriel.
Commissioner for the State at Large.	
GEO. WEST.....	Stockton.
Commissioner for the San Joaquin District.	
ISAAC DETURK.....	Santa Rosa.
Commissioner for the Sonoma District.	
ALLEN TOWLE.....	Towles.
Commissioner for the El Dorado District.	
R. D. STEPHENS.....	Sacramento.
Commissioner for the Sacramento District.	
CHARLES BUNDSCHU.....	San Francisco.
Commissioner for the San Francisco District.	

---

WINFIELD SCOTT, Secretary.....	San Francisco.
CLARENCE J. WETMORE, Chief Executive Viticultural and Health Officer.....	
.....	Livermore and San Francisco.

*Office of the Board:*

101 SANSOME STREET, SAN FRANCISCO.



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# FINANCIAL REPORT OF JOHN T. DOYLE,

President of the Board of State Viticultural Commissioners.

SAN FRANCISCO, September 1, 1894.

*To his Excellency H. H. MARKHAM, Governor of the State of California:*

SIR: I herewith transmit the financial report of the Board of State Viticultural Commissioners, showing the receipts and disbursements of the Board during the forty-fifth fiscal year.

You will find annexed the financial statement furnished by C. J. Wetmore, Chief Executive Officer.

Respectfully submitted.

JOHN T. DOYLE,

President of the Board of State Viticultural Commissioners.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: I respectfully submit the following report of receipts and expenditures for the forty-fifth fiscal year, and the amount available for the forty-sixth fiscal year.

## RECEIPTS.

Amount appropriated by the State Legislature for the use of the State Viticultural Commission for the forty-fifth and forty-sixth fiscal years..... \$30,000 00

## EXPENDITURES.

(Forty-fifth fiscal year.)

Salaries.....	\$3,000 00	
Office expenses, including salaries of employes and rent.....	4,378 90	
Work outside State (including work done at World's Fair, Chicago, and at Washington, D. C.).....	3,174 68	
Statistics.....	850 00	
State Analyst.....	55 00	
Traveling expenses of Commissioners.....	35 60	
Traveling expenses of Chief Executive Officer.....	153 75	
Library.....	57 70	
Investigations.....	74 85	
Distributing information.....	82 75	
Reports.....	145 50	
Expressage.....	94 38	
Midwinter Fair.....	2,076 00	
		14,179 11

Amount available for forty-sixth fiscal year ..... \$15,820 89

Respectfully submitted.

C. J. WETMORE,  
Chief Executive Officer.



## REPORT OF JOHN T. DOYLE,

President of the Board of State Viticultural Commissioners.

SAN FRANCISCO, September 12, 1894.

*Hon. H. H. MARKHAM, Governor of California:*

SIR: As President of the State Viticultural Commission, I submit to your Excellency the following report. The reports of the members appointed from the several viticultural districts, which accompany it, may be relied on for all information of a local character, and I shall therefore confine myself to matters of general interest.

Viticulture has, during the biennial period now closing, been much depressed, and at the present writing is probably at the lowest point ever touched since it was first established in this State. More wine is annually produced than the present market will take, and prices have consequently gone down to a point where production is conducted at a steady loss to the wine farmer. Ordinarily in such cases a remedy would be found in ceasing to plant what can only be produced at a loss; but such a remedy is inapplicable in the case of a vineyard. It is a permanent plantation, representing the labor of five years and considerable pecuniary outlay; and it must either continue to be pruned and cultivated, every season, or be grubbed out at considerable cost per acre; for, neglected, the vines will ere long become so thick and tangled as practically to afforest the land again, besides impoverishing the soil by their rampant growth. The vineyardist is thus remitted to a choice between two alternatives, each of which entails decided loss. Besides this he is embarrassed by the fact that the land best adapted to the growth of grapes is not found suitable to cereals or other annual crops. There are thousands of acres in the district I know best, which give an annual yield of six hundred gallons of wine per acre, but from which it would be difficult to get as much as half a ton of hay. The situation is thus a very sad one, for viticulture is intrinsically an industry of the highest interest to the State (as supporting a denser population than any other branch of agriculture), and it is not too much to say that California is better adapted to it than any other known region of the world. France, Spain, and Italy, the largest European wine producers, are all subject to such frequent and injurious irregularities of weather—storms of rain and hail, unseasonable frosts and blighting siroccos—that, though the vines put on in spring as bountiful a display of blossoms as with us, yet the wine produced does not on the average exceed two hundred gallons to the acre. In California I am convinced that four hundred will be found about the average. In addition to this, the unbroken sunshine of our summers, which brings the whole crop, of each variety in the vineyard, to maturity simultaneously, gives us superior material to work on, so that though we have doubtless much yet to learn as to processes of manufacture, and especially of blending and maturing wines, we are able to produce those we do grow as

cheaply as any European country, and but for our remoteness and other unfavorable conditions could compete successfully with the French in their own markets.

Two years ago, notwithstanding the fact that that market requires a peculiar form of coöperation, not made in the United States (or else a loss of that actually used), our wine growers looked hopefully to France as a market for our surplus; and a single large shipment was successfully made there. Had our Government offered any reciprocal advantage to French products, there is excellent reason to believe that our wines could have secured free entry into France, to the incalculable advantage of our State; and those were the days of reciprocity. But either because there was no one in authority or having its ear, in Washington, who took an interest in the question, or perhaps by reason of difficulties unknown to us, the effort was not made, and a new French tariff, then adopted, put an end to that hope probably forever.

Our wine growers were also sanguine that the great Columbian Exposition at Chicago would afford the occasion for a display of our products which would not fail to bring them to the favorable notice of the civilized world; and great hopes were indulged in on this basis. The State and several of the counties incurred considerable expense to make a creditable display of our varied agricultural and horticultural products. Whatever result of good may have attended these efforts in other departments, it is certain that so far as viticulture is concerned, they were a dismal failure. The difficulty began at the beginning. The distribution of space was first confided to the California Commissioners; after they had undertaken it, the same duty was delegated to Mr. La Rue, chief of viticulture in the Department of Horticulture. No notice of the change was given to the first named gentlemen, and perhaps Mr. La Rue himself was not apprised that there was a change. He, though assiduous enough while seeking the position, was afterwards so engrossed by its duties at Chicago that we saw no more of him in California. Circulars were issued to proposed exhibitors, but the mode of conducting the Exposition, the subdivision and distribution of parts, what belonged to the State's exhibit, to be displayed in its own building, and what to the viticultural department of the horticultural building, was never explained and could not be learned in this State. Most vineyardists supposed we were to contribute to a general exhibit, wherein, while each would retain his portion distinct, the State would obtain credit for the whole, and so asked space enough merely to place his products. Others not so modest—and perhaps better informed—applied for room for a moderate sized store. The whole business being conducted by correspondence with Chicago, what was asked for, conceded, done, or refused was only to be ascertained there, and each one only knew what his own letters brought him. In January, 1893, it was announced that Mr. La Rue had at length returned from Chicago and desired to confer with us at the rooms of this Commission at two o'clock p. m. on a certain day. A large number assembled to meet him, but, having forgotten to bring with him the necessary papers, he was only able to tell us the numbers of the spaces assigned to particular exhibitors, and could not locate them on the ground. It came out, however, that some four or five persons or firms had secured about nine tenths of the whole space, and that the portion awarded to the State at large was scattered about here and there in various places. For want of the necessary information it was impossible

even to suggest any remedy for this absurd state of things, and the whole matter had to be turned over to one of the employés of the California Commission, with instructions to make the best arrangement of the conflicting claims that he could, after seeing the plans and numbers and conferring with the parties interested. Some arrangement he did make, and there was an exhibit. I cannot speak of it from personal observation, but I was not surprised to be told that it was on the whole quite inferior to that of the local Midwinter Fair at San Francisco. The general dissatisfaction and disgust among those who should, and under normal circumstances would have been the exhibitors, was adverse to success.

There were other causes of just dissatisfaction. For some reason—probably the meanness of the congressional appropriation—the Fair managers felt called upon to exercise extreme economy in every department of the management. Monopolies of all kinds were created and sold, and at such high prices as to compel the purchasers (politely termed *concessionaires*) to get the utmost farthing out of them, as a condition of avoiding loss; and however harshly the monopoly worked—even though it tended to defeat the very object of the Exposition—the management could not relax it, having sold and parted with the control. From this arose that extreme parsimony and meanness which pervaded the whole atmosphere of the Exposition, to the infinite disgust of liberal minded persons connected with the management, and of all unconnected with it. By selling, for value, exclusive privileges the managers had tied their own hands and deprived themselves of the power to treat exhibitors with liberality or even with justice. This was forcibly illustrated in our case. The purchasers of the monopoly of catering (including the selling of wine) laid in a stock of wines for the anticipated trade, which they naturally purchased for as little, and proposed to sell for as much, as possible. Of course the goods purported to be European wines. Now a cardinal point in our California exhibit was to show that our State can and does furnish (quality and price both considered) better table wines—giving more value for the money—than any other country. But to this end it would be necessary to exhibit and offer them at their ordinary prices, in equal competition with the foreign articles at theirs. This privilege we were denied. A wine grower was not permitted either to sell or even give away samples of his products, lest doing so might interfere with the profits of the *concessionaire*. By a stretch of courtesy he might permit his wine to be tasted on the spot, but the worthlessness of this privilege is obvious. One fatigued with tramping through the endless aisles, galleries, and corridors of numerous buildings, is in no mood to distinguish shades of quality in wine, and indeed, has no power to do so. If he might carry away a small quantity to be consumed at his meal or at home, the producer might hope to acquaint him with the character of his goods; but this was forbidden.

The exclusive privilege of inscribing a California wine on the wine list of all the restaurants was offered for sale and at one time announced as sold for a large sum. This scandalous abuse was, however, defeated, and a general list of our wines made and printed for distribution in all the restaurants. Still, as the caterer declined to carry them on hand, the advantage of this concession was but slight. Through the efforts, however, of our Chief Viticultural Officer, who was on the spot, the privilege was obtained of having an assortment of our wines kept on sale



at one of the many restaurants; but we still remained handicapped, for the grower could not fix the price of his goods, save at rates justly regarded as extortionate. The reason of this was not to be found in the commission of twenty-five per cent on sales reserved by the management, nor in the second commission of thirty-three per cent on the remainder, exacted by the *concessionaire*; for the grower, in order to advertise his goods, might be willing to sacrifice half the amount of his sales; but the *concessionaire's* exclusive privilege stood in the way. California wines at fair, or even moderately high, prices would interfere with the sale of the stock of (presumably genuine) French wines laid in by The Wellington Catering Co., and therefore our prices had to be put up to a forbidding figure; thus willingly or unwillingly we were compelled to demand prices for our goods which either forbid their sale or brought them into ridicule. A wine which in San Francisco sells for \$5.50 a case, and is put on the tables of the hotels and restaurants here at 50, 60, or at most 75 cents per bottle, was not *permitted* to be sold for such prices. Under these circumstances, it is evident that the exhibit of our wines could only prove valueless to us. Practically all we were permitted to exhibit was the outside of the bottle! And the authorities of the Exposition frankly acknowledged this ridiculous result, by the announcement that bottles on exhibition need not be filled with wine; water would answer quite as well, and indeed had some advantages, as *not presenting so much temptation to nocturnal prowlers who might pass the night in the building.*

The distribution of awards by the managers of the Exposition was in harmony with this absurd exhibition of our goods. A conference of persons proposing to exhibit was held in San Francisco in January, 1893, and expressed its views with unanimity on two points; on which, indeed, no one possessed of any knowledge on the subject would find room for difference of opinion; they were (1) That the "*one juror* system" favored by Mr. J. Boyd Thacher (chief of that department) could not properly be applied to wine; and (2) That we desired our wines judged by European experts, and especially that no Californian should be placed on the jury. As the departure from this rule led to some subsequent acerbity of feeling, I may be pardoned for a few words in explanation of its reasons.

The wines of all countries have their peculiar characteristics, and persons accustomed to them, and highly qualified to determine the various shades of quality of one sort, may yet be quite incompetent to pass on those of another. A Bordeaux expert, for example, will not undertake to give a judgment on Spanish, Rhenish, or Portuguese wines, nor will experts in those varieties pass upon the wines of Bordeaux. Now our State within its broad domain has soils and climates of infinite variety and produces wines resembling those of nearly every country of Europe, and is the only State in the Union that does so. Our products have nothing in common with the wines grown in the Eastern States, which are not even fermented from the juice of the same fruit, for the *vitis vinifera* cannot tolerate the rigorous winters which prevail east of the Sierra Nevada. Hence, there is no real competition between our wines and those of Missouri, Ohio, Michigan, or New York, and no propriety in appointing persons accustomed to them to appreciate ours. Our wine makers aim higher; they undertake to compete with the wines of Germany, France, and Spain, and even with the superior products

of those countries, and hence naturally demanded the judgment of persons conversant with those wines as to our rank relatively to them. The "one juror system," applied properly enough to exhibits of animals, where all the different points of excellence have their relative values assigned to them, and can be ascertained by measurement or count, is obviously inapplicable to a commodity the merits of which have to be tested by the careful application of the most delicate of the senses educated to the highest point. In such cases no way of judging merit has ever been devised equal to the *consensus* of opinion of skillful experts free from the prejudice liable to be derived from a knowledge of capsules, corks, labels, and other marks of origin. We desired also to shun the judgment of Californians, lest they should be deemed prejudiced in our favor, preferring to challenge criticism rather than to possibly be charged with prevailing by favor. *Fas est et ab hoste doceri.*

These views of the California exhibitors were made known to the authorities of the Exposition and secured some attention from them; but one of the Commissioners then in office—himself an exhibitor—either differing from, or forgetting the deliberate judgment of his *confreres*, being in Chicago, urged upon those in authority there, the *right* of California to *representation* on the wine jury! We are so accustomed to the idea of representing different interests on our political committees and on other public occasions, that this suggestion was favorably received; and probably on the same principle other States were accorded the like right. Learning by private telegram that his suggestion had been adopted, the Commissioner in question lost no time in nominating a candidate for the position, whose appointment was at once made, and announced by the press on the following morning. The gentleman thus nominated set off without delay for the scene of his labors. This performance, as soon as known, gave rise to great dissatisfaction among the wine growers, as may be readily understood. Whatever confidence might have been reposed in Mr. Pacheco's impartiality, had he been selected independently, was destroyed by the fact that he was named by one of the exhibitors. The situation was in no way mended by the choice of the other members of the jury. Two Spanish Commissioners were appointed to judge the wines of Spain, and those of Portugal were treated in the same way. France indignantly withdrew her exhibit, and, had authority for the purpose existed, California would doubtless have done the same. The other jurors were Americans selected from various States, as Missouri, Ohio, Illinois, Kentucky, etc., and the only one among them generally known as an expert in wines, naturally declined to serve. All this was evidently intended to class our wines with those of Missouri, Ohio, New York, etc., and pointed so clearly to a coming judgment of the wines of each State, by the juror from that State and representing it, as to lead to a general expression of indignation and disgust from those interested; for it was quite absurd and precisely the reverse in every respect of what we had demanded. The universal expression of dissatisfaction, both by the exhibitors and the press, prevented the consummation of the "one juror" outrage, and the expedient of the gentlemen who did act silenced individual complaint, for they, with magnificent impartiality, gave awards to *all* the exhibitors whose wines arrived in marketable condition, so that no one could complain that his merits had been overlooked. This was not, however, what was looked for from the great Columbian Exposition.



In order that the money and effort spent in our exhibit might not be wholly without fruit, this Commission, voicing the wishes of the viticulturists of the State, dispatched one of our former members to Chicago, who was successful in inducing the representative of the British Government to appoint a competent expert in the wines sold in the London market, to examine and present to him for the use of his government, a critical report on the California wines exhibited. This duty was discharged with great care by Mr. C. F. Oldham, the gentleman selected, and his report, forming part of the general report of the English Commissioners to the Exposition, can hardly fail to attract attention abroad. It has in fact been made public in England, and while discriminating between products of different individuals and localities, is on the whole highly laudatory of California viticulture.

During the summer just past, an effort was made to secure better prices for wine by the organization of a syndicate to control the bulk of the crop; and offers of the capital needed for the purpose encouraged an effort to that end. For this purpose options to buy the growing crop, at prices materially above those prevailing last year, were with considerable effort and the expenditure of a small sum of money secured from the great mass of growers, covering perhaps eighty per cent of the total crop of the State. When accepted by the syndicate to which they were to be transferred, they were to be molded into contracts, for the present and succeeding years up to and including 1898, at gradually advancing prices, which would have given the growers some moderate return for their capital and labor. When the options had been collected, however, instead of treating with those whose offers had originally incited the effort, overtures to the like effect from large wine dealers of San Francisco were listened to, and the result, as might have been foreseen, was that after much negotiation, differences arose as to the exact terms of the proposed contracts, which were discovered to be insuperable only when it had become too late to shift front; and the whole project fell through. I hoped to be able to chronicle the success of this movement in the present report, but am denied that satisfaction. It is to be hoped that between this time and the vintage of 1895 some such arrangement will be made, and the industry of which the State is so justly proud may be rescued from its present prostrate condition.

It is to be regretted that the numerous and respectable body of citizens who devote themselves so earnestly to the eradication of the vice of drunkenness, have never turned their attention to the advantages of California wine as a promoter of temperance. It is abundantly proved by statistics, and indeed, is the common observation of travelers, that the nations in which the daily beverage of the people is light wine are conspicuously temperate ones. Intoxication, so common in all countries of the north of Europe, and unfortunately in our own country, too, is extremely rare in southern Europe, where wine is the ordinary beverage of the inhabitants. It is stated, too, by standard writers, that chemists now recognize some twenty-five or thirty different varieties of alcohol, distilled from different sorts of vegetable substances, differing very slightly in chemical composition, all efficient as intoxicants, but widely different in their hygienic effects. Of all these the alcohol distilled from wine is the most adapted to medicinal use, and the least injurious under any circumstances. On the other hand, that produced from the potato is in every sense the worst; the intoxication



resulting from it is accompanied by quarrelsomeness and violence, and the use of it generates that *alcoholic thirst* which is the prolific parent of so much crime and misery. Now, universal experience proves that mankind will have and use some sort of stimulant; the Asiatic nations, from the earliest dawn of civilization, used wine. It is referred to in the most ancient records of the human race. The savages of the interior of Africa, and those of this continent, as well as of the many islands which dot the ocean, have all found the means of procuring alcohol from plants of different sorts. It is worthy of remark that the nations which took the lead in civilization, so far as history shows, and the conquering races, both of ancient and modern times, were the wine-drinking peoples; the Greeks and the Romans in ancient times and the French in mediæval and modern days. The degeneracy which some perceive in their descendants in our own day, and the increase of intoxication among them, are ascribable to the introduction of German *potato alcohol*, which is lately finding its way all over the south of Europe as the basis of various compounds, such as vermouth and other cordials. I am persuaded that if the advocates of temperance, enforced or encouraged by law, would direct their efforts to a discrimination in the license law, in favor of our native wines carrying a low percentage of alcohol, and otherwise encourage the consumption of them, they would be rewarded by a sensible diminution of intoxication, and that within a very short time. I have myself managed and controlled a large vineyard for the last fourteen years, during all but a portion of the first year of which, the laborers have all been from southern Europe and their customary daily beverage, wine. They drink it at their meals and carry it afield with them when at work, and during the whole period we have not had a single case of intoxication on the place.

## STATISTICAL.

The statistics of the movement of wine and brandy from California points have been kept by the Commission with the usual care. The Secretary has made it a point to attend to these details personally.

The receipts of wine and brandy at San Francisco have been as follows:

## RECEIPTS OF WINE AND BRANDY AT SAN FRANCISCO FROM THE INTERIOR.

Year.	Wine— Gallons.	Brandy— Gallons.
1892 -----	9,474,353	636,080
1893 -----	11,836,750	693,059

Turning now to the question of exports, the details for the years 1892 and 1893 are as follows:

## TOTAL WINE SHIPMENTS.

Year.	By Sea.		By Rail Overland.		Grand Total.		Total Value.	Average Price per Gallon.
	Cases.	Gallons.	Cases.	Gallons.	Cases.	Gallons.		
1892 ---	15,876	4,843,128	36,948	6,330,624	52,824	11,117,752	\$5,016,158	\$0 44 <sup>5</sup> / <sub>8</sub> *
1893 ---	13,344	3,704,834	37,702	8,621,199	51,046	12,326,033	5,355,093	43 *

\* Estimating 2<sup>1</sup>/<sub>2</sub> gallons to the case in the totals.

## TOTAL BRANDY SHIPMENTS.

Year.	By Sea.		By Rail Overland.		Grand Total.		Total Value.	Average Price per Gallon.
	Cases.	Gallons.	Cases.	Gallons.	Cases.	Gallons.		
1892 ---	667	539,957	2,554	366,763	3,221	906,720	\$1,297,396	\$1 41 $\frac{1}{4}$ *
1893 ---	332	292,434	1,766	495,908	2,098	788,342	1,188,557	1 50 nearly.*

\* Estimating 2 $\frac{1}{2}$  gallons to the case in the totals.

In order to compare the exports of wines to different points for the two years, the following tables have been prepared, taking up the statistics from the point left by my predecessor, Hon. J. DeBarth Shorb:

## SHIPMENTS OF WINE BY SEA.

Year.	Cases.	Bulk Gallons.	Value.
<i>To New York—</i>			
1892.....	2,848	4,331,802	\$1,983,306
1893.....	1,079	3,134,969	1,458,331
<i>To Central America—</i>			
1892.....	9,496	90,325	107,864
1893.....	9,562	94,711	98,407
<i>To Mexico—</i>			
1892.....	1,156	82,571	50,222
1893.....	471	86,729	39,980
<i>To Hawaii—</i>			
1892.....	743	113,239	81,465
1893.....	726	140,338	84,331
<i>To British Columbia—</i>			
1892.....	517	18,392	11,073
1893.....	493	18,099	11,120
<i>To Japan and China—</i>			
1892.....	378	42,149	17,544
1893.....	444	38,897	17,407
<i>To Great Britain—</i>			
1892.....	174	72,843	32,621
1893.....	54	63,542	27,415
<i>To Germany—</i>			
1892.....	216	58,119	26,780
1893.....	107	15,226	8,824
<i>To Other European Countries—</i>			
1892.....	10	12,038	4,684
1893.....	10	15,776	4,463
<i>To Tahiti—</i>			
1892.....	1	16,105	5,526
1893.....	1	38,638	9,284
<i>To All Other Foreign Countries—</i>			
1892.....	337	5,545	5,036
1893.....	397	7,909	5,844

The shipments of brandy, by sea, to various ports in the two years named have been as follows:

## SHIPMENTS OF BRANDY BY SEA.

Year.	Cases.	Bulk Gallons.	Value.
<i>To Domestic Eastern Ports—</i>			
1892.....	46	290,864	\$525,870
1893.....	10	190,766	351,227
<i>To Germany—</i>			
1892.....	3	131,375	111,706
1893.....		61,068	51,465
<i>To Great Britain—</i>			
1892.....	10	109,028	70,306
1893.....		31,011	27,669
<i>To All Other Foreign Ports—</i>			
1892.....	608	8,690	13,820
1893.....	322	9,579	12,236

## DETAILS OF OVERLAND SHIPMENTS.

The details of overland shipments for the two years 1892 and 1893 will be found annexed. They will bear careful study.

## WINE AND BRANDY OVERLAND, FOR THE YEAR 1892.

To—	Wine.		Brandy.	
	Cases.	Gallons.	Cases.	Gallons.
Boston.....	269	13,254		750
Providence.....	12	275		
Other New England points.....	613	18,902	7	683
Buffalo.....	146	9,942		578
New York.....	5,347	614,998	24	51,461
Rochester.....		5,586		
Other New York points.....	409	9,242	19	448
Philadelphia.....	612	12,512	8	1,197
Pittsburg.....	554	380,204	82	238
Other Pennsylvania points.....	678	20,450	14	1,129
Washington.....	142	29,674	7	1,204
Baltimore.....	89	757	1	
Other West Virginia, Virginia, and Maryland points.....	110	1,184	34	
Charleston, S. C.....	13	134		
Atlanta.....	5	922		10
Savannah.....	500	115		
Other Carolina and Georgia points.....	179	473	2	
Birmingham.....	20	11,893		
Mobile.....	224	28,661		111
Pensacola.....		5,635		
Other Eastern Gulf States.....	251	13,846	39	1,101
New Orleans.....	668	2,857,444	34	1,742
Donaldsville.....		7,623		
Baton Rouge.....		2,355		
Plaquemine.....		9,250		
Other Louisiana points.....	149	33,718	18	594
Dallas.....	215	16,875		755
Fort Worth.....	49	18,532	3	
Austin.....	25	2,006		
Galveston.....	703	100,042	19	1,822
Houston.....	336	18,916		716
San Antonio.....	557	36,136	39	3,066
Waco.....	1	2,215		



## WINE AND BRANDY OVERLAND, FOR THE YEAR 1892—Continued.

To—	Wine.		Brandy.	
	Cases.	Gallons.	Cases.	Gallons.
Other Texas points.....	842	35,460	72	2,708
Hot Springs.....		521	1	
Little Rock.....	7	1,851		184
Other Arkansas and Indian Territory points.....	114	1,114	10	5
Memphis.....	14	22,851		1,036
Chattanooga.....		92		
Louisville.....	20	48,042		1,390
Other Tennessee and Kentucky points.....	110	4,839	10	
Cincinnati.....	594	147,863	4	11,585
Cleveland.....	145	6,589	3	833
Toledo.....	199	16,051	2	123
Other Ohio points.....	213	13,238	38	828
Indianapolis.....	68	17,461		1,558
Other Indiana points.....	142	6,996	24	178
Chicago.....	3,676	881,420	156	102,399
Rock Island.....	60	3,606		1,070
Other Illinois points.....	244	32,551	45	3,817
Detroit.....	57	14,688	2	693
Grand Rapids.....		3,365		
Other Michigan points.....	172	15,834	18	1,215
Milwaukee.....	137	113,562	13	24,938
Other Wisconsin points.....	260	12,297	26	1,403
St. Louis.....	831	263,557	12	23,043
Kansas City.....	956	80,540	14	7,489
St. Joseph.....	143	17,855		5,015
Other Missouri points.....	112	1,235	13	264
Council Bluffs.....	28	17,844		112
Dubuque.....	21	4,964		621
Sioux City.....	61	2,030	4	1,350
Davenport.....	1	5,825	1	
Other Iowa points.....	283	10,317	35	4,432
St. Paul.....	470	100,593	4	16,085
Minneapolis.....	203	53,121		9,222
St. Cloud.....		4,765		
Other Minnesota points.....	137	17,729	4	1,545
Omaha.....	457	34,484	31	10,848
Atchison.....		82		
Topeka.....	1	14		
Other Kansas and Nebraska points.....	653	21,323	23	3,237
Dakotas.....	136	12,921	6	1,814
Denver.....	3,315	108,991	71	12,421
Pueblo.....	723	16,484	28	2,501
Other Colorado points.....	2,837	76,116	752	14,160
New Mexico.....	1,061	32,375	199	4,064
Utah.....	2,022	40,778	337	13,991
Montana and Idaho.....	2,182	106,432	268	15,762
Foreign.....	171	32,623	18	196
Totals.....	36,948	6,330,624	2,554	366,763

## WINE AND BRANDY OVERLAND, FOR THE YEAR 1892—Continued.

From—	Wine.		Brandy.	
	Cases.	Gallons.	Cases.	Gallons.
San Francisco.....	25,519	4,335,210	1,921	236,735
Oakland.....	772	13,177	30	1,531
Alameda.....	7	30		
Pleasanton.....	4	12,452		392
Livermore.....	144	32,217	3	487
Irvington.....	896	56,075		15
Warm Springs.....	4	1,149		
Menlo Park.....	23	25,257		
Mountain View.....	20	10,024		
Santa Clara.....	9	18,856		48
San José.....	1,484	104,412	406	5,074
Los Gatos.....	431	7,629	7	250
Gilroy.....		36		
Boulder Creek.....		209		
Santa Cruz.....	122	6,953	5	135
Martinez.....	12	1,266		
Concord.....		22,996	5	15
Antioch.....		96		
Cornwall.....		95		
Lathrop.....		26		
Stockton.....	231	41,906	2	612
Ione.....		969		40
Oakdale.....	1	291		
Lodi.....	2			
Sacramento.....	371	83,633	17	1,250
McConnell.....		3,060		
Elk Grove.....		7,250		
Folsom.....		5,131		2,143
Diamond.....	1			
Rocklin.....		94		
Loomis.....		42		
Colfax.....		139		
Placerville.....		525		
Woodland.....		6,160		10
Davisville.....				44
Gridley.....		23		
Oroville.....		648		
Marysville.....	19	1,120	1	1,973
Vina.....	66	20,110	17	53,646
Redding.....	1	10		
Suisun.....		56		
Elmira.....		26		
Cordelia.....	26	9,716		2,000
South Vallejo.....	4			
Napa.....	112	148,275	2	5,508
Yountville.....		592		
Oakville.....	6	552,439		1,070
Rutherford.....	14	12,740		25
Larkmead.....	12			
Bano.....		5,050		50
Bale.....		27		
Krug.....	20	9,230	7	1,079
Bello.....		21		
St. Helena.....	196	107,190	8	12,715
Calistoga.....	22	7,873		
Sonoma.....		123		
Sobre Vista.....		2,215		
Glen Ellen.....	1	13,956		267
El Verano.....		4,881		25
Yulupa.....		3,145		
South Los Guillicos.....		10,148		
Vineyard.....		58,387		1,789
Santa Rosa.....	61	72,404	1	2,416
Neville.....		177		10
Sebastopol.....	3	443		10
Fulton.....		2,352		
Korbels.....	730	25,279		965

## WINE AND BRANDY OVERLAND, FOR THE YEAR 1892—Continued.

From—	Wine.		Brandy.	
	Cases.	Gallons.	Cases.	Gallons.
Geyserville.....		17,802		
Healdsburg.....	1	19,981		223
Asti.....		7,405		2,280
Cloverdale.....		497		250
Ukiah.....	88	412		32
Fresno.....	50	148,774		2,547
Fowler.....		26		
Traver.....		27		
Bakersfield.....		10		
Los Angeles.....	5,345	123,749	115	10,540
San Gabriel.....	81	74,267	2	14,785
Glendale.....		2,000		172
Guasti.....		17,853		311
Downey.....		8,107		247
Savanna.....	3			
Fernando.....		20		
Santa Ana.....	2	1,343	4	499
Pomona.....		26,067		
Norwalk.....		16,192		174
San Pedro.....		300		56
Winthrop.....	10	1,364	1	141
Anaheim.....	1	9,664		1,180
Cucamonga.....		8,707		
Colton.....		12,771		75
Redlands.....		36		5
Brookside.....		12,000		
San Bernardino.....		9,750		
Santa Paula.....		53		
Santa Barbara.....	28	1,294		
Portland.....				127
Totals.....	36,948	6,330,624	2,554	366,763

## WINE AND BRANDY OVERLAND, FOR THE YEAR 1893.

To—	Brandy.		Wine.	
	Cases.	Gallons.	Cases.	Gallons.
Boston.....	2	44	628	15,596
Other New England points.....	16	207	523	21,392
Buffalo.....		315	123	11,033
New York.....	23	111,919	6,330	3,439,509
Other New York points.....	2	3,282	861	49,338
Philadelphia.....	4	143	481	32,528
Pittsburg.....	4	1,746	216	38,479
Other Pennsylvania points.....	11	1,165	365	16,118
Baltimore.....			85	736
Washington.....	1	1,234	91	38,247
Other W. Va., Va., and Maryland points.....	2	120	55	2,819
Charleston.....			8	33
Wilmington.....				175
Atlanta.....			12	2,180
Savannah.....				3,215
Other Carolina and Georgia points.....	2	25	197	5,001
Baton Rouge.....			2	7,174
New Orleans.....	16	3,739	671	3,089,216
Other Louisiana points.....	6	363	134	111,825
Birmingham.....			1	11,902
Mobile.....		91	215	29,125
Plaquemine.....			3	19,337
Montgomery.....			117	1,928



## WINE AND BRANDY OVERLAND, FOR THE YEAR 1893—Continued.

To—	Brandy.		Wine.	
	Cases.	Gallons.	Cases.	Gallons.
Other Eastern Gulf States .....	22	571	292	32,711
Galveston .....	12	3,804	864	98,821
Houston .....	4	36	143	10,022
San Antonio .....	3	1,719	354	44,010
Austin .....	—	201	10	3,623
Dallas .....	3	347	543	21,085
Fort Worth .....	12	193	154	3,969
Other Texas points .....	123	2,634	902	34,918
Hot Springs .....	—	46	2	375
Memphis .....	—	347	3	12,489
Little Rock .....	—	—	22	62
Other Arkansas and Indian Ty. points .....	—	24	99	1,278
Louisville .....	23	223	103	52,201
Other Tennessee and Kentucky points .....	—	190	58	8,393
Cincinnati .....	1	8,306	749	143,558
Columbus .....	—	—	—	2,563
Cleveland .....	—	423	84	23,687
Toledo .....	—	699	30	14,211
Other Ohio points .....	13	244	224	8,437
Indianapolis .....	—	399	60	16,486
Other Indiana points .....	1	127	66	16,391
Peoria .....	—	—	—	6,483
Rock Island .....	—	335	12	1,975
Chicago .....	281	106,360	9,590	830,075
Other Illinois points .....	5	4,241	327	32,920
Other Michigan points .....	5	1,089	372	35,947
Milwaukee .....	27	25,561	491	120,467
Other Wisconsin points .....	2	543	89	9,003
St. Louis .....	1	263	481	328,548
St. Joseph .....	8	1,393	171	8,910
Kansas City .....	4	10,581	810	81,658
Other Missouri points .....	—	92	56	1,931
Davenport .....	—	1,127	—	3,759
Dubuque .....	—	767	22	15,012
Council Bluffs .....	—	1,407	—	5,040
Sioux City .....	—	1,121	6	41
Other Iowa points .....	3	1,749	341	15,902
Minneapolis .....	2	9,813	216	32,118
St. Paul .....	63	10,347	272	62,621
Other Minnesota points .....	5	2,266	64	12,644
Lincoln .....	—	1,360	11	1,096
Atchison .....	—	1,220	—	1,880
Omaha .....	11	12,613	377	38,087
Other Kansas and Nebraska points .....	21	1,820	383	15,597
Dakotas .....	11	2,070	363	10,291
Denver .....	150	8,876	2,394	87,669
Pueblo .....	8	512	204	9,387
Other Colorado points .....	414	8,292	1,631	80,361
Montana and Idaho .....	113	8,449	1,281	62,227
Utah .....	193	6,882	1,047	28,631
Albuquerque .....	107	4,717	701	23,890
Mexico .....	10	553	95	29,545
Bremen, Germany .....	—	25	4	44,625
Holland .....	—	—	—	2,459
England .....	—	—	18	21,269
Belgium .....	—	—	1	7,712
Other foreign points .....	—	14	12	14,558
Totals .....	1,766	495,908	37,702	8,621,199

## WINE AND BRANDY OVERLAND, FOR THE YEAR 1893—Continued.

From—	Brandy.		Wine.	
	Cases.	Gallons.	Cases.	Gallons.
San Francisco.....	1,285	277,072	29,225	5,581,621
Oakland.....	10	139	89	3,556
Alameda.....			3	201
Pleasanton.....		5	21	5,305
Martinez.....				709
Livermore.....	19	73	81	45,463
Concord.....		652	15	30,625
Stockton.....	10	10,676	200	57,825
Marysville.....	3	186	20	1,999
Vina.....	108	67,904	176	15,537
Sacramento.....	11	10,932	201	68,515
Fresno.....		23,715	33	182,868
Lincoln.....				181
Chico.....				171
San José.....	219	5,548	1,103	204,012
Warm Springs.....			45	10,515
Menlo Park.....			3	12,545
Mountain View.....		14	17	59,671
Redwood.....		4	28	273
Irvington.....		55	610	51,544
Los Gatos.....			39	14,147
Gilroy.....				10,764
Mayfield.....			3	
Oroville.....			25	1,081
Madrone.....				397
Hollister.....			1	172
West's Spur.....		10,460		53,688
Sierra Vista.....		2,160		4,635
Antioch.....				66
Cornwall.....				381
Oakdale.....				461
Modesto.....				48
Bakersfield.....				2
Santa Clara.....				8,008
Santa Cruz.....	12	399	31	5,832
Elk Grove.....		25		4,638
Hermitage.....				11
Napa.....	4	10,706	87	539,478
Oakville.....		1,033	16	271,462
Yountville.....		5	34	562
Rutherford.....		44		9,915
Ukiah.....				479
Routier.....				45
El Verano.....				473
Bello.....				114,795
Yulupa.....				20,990
Vineland.....		219	2	74,173
St. Helena.....		14,529	222	18,831
Krug.....	1	605	27	9,169
Dixon.....				15
Woodland.....				149
South Vallejo.....		33	2	65
Larkmead.....		7	14	
Glen Ellen.....		900	26	7,747
Shellville.....		25		5,682
Sobre Vista.....				2,522
Drummond.....				4,665
Elmira.....				50
Calistoga.....			23	16,970
Cordelia.....		240	25	9,673
Cloverdale.....			2	2,913
Vineyard.....		1,379		82,616
Geyserville.....				9,775
Chiquita.....		200		13,460
Guerneville.....				35
Trenton.....				96
Los Guilicos.....		2,422		5,080

## WINE AND BRANDY OVERLAND, FOR THE YEAR 1893—Continued.

From—	Brandy.		Wine.	
	Cases.	Gallons.	Cases.	Gallons.
Sonoma.....		243		2,481
Annadel.....		10		2,555
Windsor.....				5,045
Santa Rosa.....	1	3,060	12	91,130
Asti.....		778	61	21,548
Korbels.....		3,172	177	31,913
Petaluma.....				10
Colfax.....				47
Healdsburg.....	4	40		16,725
Ione.....		15		1,662
Folsom.....		90		2,396
Natoma.....				17,508
Brighton.....				27
Placerville.....		10		268
Latrobe.....				30
Diamond.....				26
Rocklin.....				91
Auburn.....		31		85
Cucamonga.....				169
Downey.....		213		536
Newark.....				2,570
Alhambra.....		23		
Anaheim.....		180		2,626
West Glendale.....				15,682
Colton.....				40
Los Angeles.....	73	7,874	4,054	122,105
Sunny Slope.....		1,223		12,980
Shorb.....				2,923
Guasti.....		50		4,695
San Gabriel.....	2	5,955	76	58,455
Ontario.....				52
Pomona.....				30,433
San Buenaventura.....				159
Santa Ana.....	2	279	2	661
Wilmington.....				220
Winthrop.....	1	119	16	1,318
Santa Barbara.....		15	25	1,552
Totals.....	1,766	495,908	37,702	8,621,199

## IMPORTS OF FOREIGN LIQUORS.

In this connection it will be found interesting to compare these figures with the statistics of imports of foreign wines and brandies at San Francisco. These will be found below:

## IMPORTS OF STILL WINES IN CASKS.

Year.	Gallons.	Value.
1892.....	54,733	\$38,659
1893.....	51,276	34,955

## IMPORTS OF STILL WINES IN BOTTLES.

Year.	Dozens.	Value.
1892.....	16,910	\$70,684
1893.....	22,888	89,209



## IMPORTS OF CHAMPAGNES AND ALL SPARKLING WINES.

Year.	Dozens.	Value.
1892 .....	19,486	\$312,503
1893 .....	16,963	257,435

## IMPORTS OF BRANDY.

Year.	Proof Gallons.	Value.
1892 .....	15,003	\$39,312
1893 .....	11,519	32,985

Respectfully submitted.

JOHN T. DOYLE,  
President.

## PROGRESS REPORTS OF CLARENCE J. WETMORE, CHIEF EXECUTIVE OFFICER.

### FIRST REPORT.

Read at the meeting of the Board held December 12, 1892.

SAN FRANCISCO, December 12, 1892.

*To the Board of State Viticultural Commissioners.*

GENTLEMEN: Acting under the direction of your Executive Committee, I have taken steps to establish four experimental plots for the purpose of testing the resistant properties of the different so-called resistant vines. One of these plots will be located at Oakville, Napa County, in H. W. Crabb's vineyard; one in I. De Turk's vineyard, South Los Guillicos, Sonoma County; one in W. B. West's vineyard, Stockton, San Joaquin County, and the other in Santa Clara County, the location not determined as yet. In these plots I will plant the following varieties of American vines: Solonis, Riparia, Lenoir, Rupestris, York-Madeira, Cunningham, Cyntheana, Noah, Cinerea, Champini, and four hybrids that I have ordered from France that are reported to be perfectly resistant. Some of these varieties I cannot obtain the rooted vines, and have therefore had to procure cuttings. The cuttings will be planted carefully in the plots, and enough of them put in nursery to take the place, the next year, of those that do not grow. In a year's time I will be able to report on the growth made by the different varieties. The resistant properties of the varieties cannot be determined for several years.

The demand for Riparia vines is very great this year, and there are practically none to be had in the State. The suggestion offered by Commissioner Priber, some time ago, that this Commission take some steps to raise these vines and sell them to vineyardists at actual cost, should be acted upon at this meeting. A carload of Riparia cuttings could be obtained from Nebraska at a moderate cost, and arrangements could be made to have them rooted. I know of no nurseryman who intends to root Riparia cuttings in large quantities, and in order that the demand for these vines might be satisfied it will be necessary for the Commission to act in the matter. We have sufficient funds now to make the experiment, and it could be made without costing the State a cent.

Yours, respectfully,

CLARENCE J. WETMORE,  
Chief Executive Officer.

## SECOND REPORT.

Read at the meeting of the Board held December 11, 1893.

SAN FRANCISCO, December 11, 1893.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: During the past six months I have visited most of the vine-growing sections of the State for the purpose of determining the condition of the grape crop of 1893, and also to observe the progress made by the different vine diseases. In almost every district the grapes were found to be in excellent condition. There was no damage from frost in the spring, with the possible exception of a few low-lying vineyards in Sonoma County. The temperature during the summer months was comparatively low and the grapes were not injured by the sun. In some places, where the vines were not well sulphured, oidium did some damage, but the loss in the aggregate was small. The early fall rains did some damage to the grapes in Napa and Sonoma Counties, but those in the other counties escaped injury. When the grapes were ripe they were in better condition than I have ever seen them before, and a large proportion of the wine made this year should be of fine quality.

The phylloxera is still spreading and new spots are constantly being discovered. I have had a great many vines sent to me, during the past six months, for examination, and on nearly all of them I have found the phylloxera. The demand for resistant vines continues good, but the supply in the State does not equal the demand. I know of one party who has this year sent to Missouri for 500,000 *Riparia* cuttings for planting in his vineyard in Sonoma County. The *Riparia* is still the favorite variety, and in fact, hardly any other is planted, simply for the reason that our knowledge of the other resistant varieties is very limited. The establishment of our experimental plots may throw more light on this subject in the future. Unfortunately the late spring rains retarded the planting of the vines and cuttings in the plots, and a good stand was not secured. Most of the vines are growing, but only a few of the cuttings took root. I will fill out the plots, as far as I can, with vines rooted at my vineyard. In studying the different varieties at the nursery on my place, I found that of the cuttings planted more of the *Solonis* took root than of any of the others. Fully ninety-five per cent of *Solonis* cuttings grew. The *Rupestris* came next; then *Champini*. Very few of the *Berlandieri* or *Cinerea* took root. I have great hopes that the *Solonis* will prove resistant in the different portions of the State. In France M. Gos informed me that it was very resistant in calcareous soils. The chief points of merit are: (1) Roots easily from cuttings; (2) Is a strong and vigorous grower.

Of the hybrids that I imported from France I cannot at present report definitely upon. So far the *Alicante Bouschet Rupestris* seems to be the strongest grower.

*Southern Vine Disease.*—In company with Commissioner Bichowsky, I examined the vineyards in Los Angeles County for the purpose of determining the progress of the Anaheim disease. At the time I was there (the latter part of July), the disease did not show itself very much, and the foliage was extremely healthy. Some vines that were abandoned a few years ago, but not pulled up, bore this year a good crop of



grapes. A few vines showed the disease, which proved that the disease had not disappeared. If the proper conditions present themselves again, the vines may suffer as they did a few years ago. During August and September I learned from Commissioner Bichowsky that the disease showed itself in a more marked degree. I examined the vines in the L. J. Rose Co.'s vineyard to see if there was any phylloxera, but did not find any. Around Santa Ana and Orange the young Muscat vineyards are doing well, but the disease has appeared among them; at present it does not seem to destroy the vines. The small vineyard near Santa Ana in which the phylloxera was found the past year, has been rooted up. A few suckers came up this year from the roots left in the ground and so kept the roots alive, and on these roots the phylloxera still lives. The County Commissioner will now apply bisulphide of carbon, and so treat the ground that all of the roots will be killed. The danger of spreading the disease from this vineyard is very small, as there are no other vineyards near it.

The nature of the exhibit that this Commission will make at the Mid-winter Fair should be determined upon at this meeting. The Executive Committee have agreed to spend about \$2,000 on an exhibit, and have agreed to place it in the collective exhibit. Some plan should be adopted so that all bills for the exhibit will be readily allowed by the State Board of Examiners.

Respectfully,

C. J. WETMORE,  
Chief Executive Officer.

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### THIRD REPORT.

Read at the meeting of the Board held June 11, 1894.

SAN FRANCISCO, June 11, 1894.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: During the past year I have visited most of the vine-growing sections of the State for the purpose of determining the progress made by the phylloxera and the "southern vine disease," and I am now able to make the following report:

*Southern Vine Disease.*—In July, 1893, in company with Commissioner E. C. Bichowsky and Professor Ethelbert Dowlen, I made a thorough examination of the vines in the San Gabriel Valley. The vines were found to be in a very healthy condition, much more so than for several years past. Some few signs of the Anaheim disease were observed, but there were but few vines found to be dying. Several patches of vines that had been abandoned a few years ago, as destroyed by the disease, were this year throwing out good strong canes, and were well loaded with fruit. In the L. J. Rose Company's vineyard a great many young vines had been planted, which showed no signs of the disease, and were making a good growth. In the vicinity of Anaheim and Santa Ana the disease was found among some of the two and three-year-old Muscat vines. From what I could see and learn the disease still exists in the vineyards of Southern California, but the effects of the disease are not as severe as they used to be. If the proper conditions present themselves again, the disease will no doubt again become epidemic.

*Phylloxera*.—The damage done to vines by the ravages of phylloxera is no longer confined to Napa and Sonoma Counties, for the vines in all the bay counties are now more or less affected. The amount of damage done so far in Alameda, Santa Clara, and San Mateo Counties is not very great, but the phylloxera having now obtained a foothold in these counties, many thousands of acres will be destroyed during the next five or six years. A few resistant vines are being planted, but the total amount is not very great. As no new vineyards are being planted, the phylloxera will be the cause of a great decrease in the output of wine during the next few years.

The grape crop of 1893 was an exceptionally large one. All of the climatic conditions during the year were favorable to the development of the vine and fruit. There were no frosts, coulure, or mildew to cut off any of the crop, and the heat of the sun was at no time severe enough to do any damage to the grapes. The grapes ripened perfectly, and, generally speaking, good wines were made. In some localities a deficiency of sugar in the grapes was noted, and also a lack of color in some wines. Generally speaking, however, the wines of 1893 have given good satisfaction.

As near as can be estimated, the amount of wine produced in the State in 1893 was as follows:

Dry wines.....	17,000,000 gallons.
Sweet wines.....	4,000,000 gallons.
Total.....	21,000,000 gallons.

Besides this wine, at least 2,000,000 gallons of brandy were made, representing an equivalent of 10,000,000 gallons of wine, so that if all the grapes had been turned into wine the output would have been in the neighborhood of 31,000,000 gallons, or about 400 gallons for every acre of wine grapes planted.

*Crop of 1894*.—At the present time it is impossible to make an accurate estimate of the coming crop, but every one concedes that it will be much less than that of 1893. The frosts of April and May did considerable damage to the vines in Napa, Sonoma, Alameda, Santa Clara, and Fresno Counties, reducing the crop at least twenty per cent. Where the grapes are far enough advanced considerable coulure is noticed, and the loss from this cause may prove very great. From all appearances the Cabernet grapes will suffer very much from coulure, and there will be a short crop of those grapes. As every one is hoping for a short crop this year, no doubt they will all be satisfied.

*Condition of the Wine Market*.—Every one interested in any branch of the viticultural industry knows that the present condition of affairs, if continued long, will mean ruin to a great many people. In former years, during a depression in the business, the merchants would be making money at the expense of the producers, or vice versa; but at the present time the business is being run at a loss to both producers and merchants. Some claim that it is overproduction that causes the depression, while others think it is due to competition of some of the wine dealers. No matter what the cause may be, the most deplorable state of affairs exists, and something should be done to bring about a change.

A meeting of the wine makers of the State was called by our Secretary for June first, and at this meeting there was present representative wine

men from nearly all the viticultural districts. Resolutions offered by our President, Mr. John T. Doyle, were unanimously adopted. These resolutions stated the necessity of some action being taken to relieve the present depressed condition, the establishment of cafés in some of the principal Eastern cities, and the appointment of a committee of seven to suggest plans of action; this committee to confer with this Commission for financial assistance and support. The committee appointed at that meeting was P. C. Rossi, for Sonoma County; F. Beringer, for Napa County; F. A. West, for San Joaquin and Fresno Counties; John Swett, for Contra Costa County; E. C. Bichowsky, for Los Angeles County; Wm. Wehner, for Santa Clara County, and C. J. Wetmore, for Alameda County. This committee has had several meetings, and has finally agreed upon a plan that will bring relief at once and place the industry on a paying basis for the next five years, provided the plan outlined is supported by the grape growers and wine makers of the State. This committee now asks the financial support of this Commission, and I would recommend that such assistance should be given them. Action should be taken upon this matter at this meeting.

*Permanent Exhibits in Eastern Cities.*—The new Executive Committee appointed for the ensuing year should take immediate steps toward carrying out the recommendation of our President, Mr. John T. Doyle, relative to the establishment of permanent exhibits and cafés in some of the Eastern cities. To establish exhibits and cafés under the direct charge of this Commission would cost more money than we could afford to spend out of our present appropriation. I think, however, that some plan could be worked out so that the expense would come within our means. In conversation with Governor H. H. Markham a short time ago, I found that he was of the opinion that the main object now of this Commission should be to help producers obtain a market for their goods, and he was heartily in favor of establishing permanent exhibits in the East. Some plan of this kind might be adopted. Permanent exhibits might be established in one or two of the Eastern cities, where all of the different brands of wine and brandy could be shown. The right of selling the wines could be given to some responsible party, who would have to make terms with the different exhibitors as to commissions, etc. This would relieve the Commission of any responsibility. All this Commission would have to do would be to pay rent and to put the exhibits in place. The expense of this would not be over \$300 a month, and could be easily borne by this Commission.

*Experimental Plot.*—During the past year I have had planted in the experimental plot in Commissioner Crabb's vineyard, at Oakville, Napa County, the following vines, received from Denison, Texas, for the purpose of testing their resistant properties, and also to determine if the fruit from any of them would prove valuable enough to propagate: Brilliant, Early Wine, Rommel, America, R. W. Munson, Delicious, Big Extra, Bailey, Carman, Hermann Jaeger, W. B. Munson, Onderdonk, Black Herbemont, Newnan, Admirable, Mrs. Munson, Perry Muench, Hopkins, Gold Coin, Vinita, Neva Munson, Fern Munson, Ragan, Marguerite, Triumph, Excelsior, Moore's Diamond, and Duchess. These vines are all growing well, and in a few years' time some definite results may be obtained from them. The hybrids received from France a year ago are doing well, and show some fruit this year. If they resist the phylloxera they will be of great value, for being direct producers, there



will be no expense of grafting. Mr. Crabb will save the wood from these vines and graft other vines with them.

*State Fair.*—Recognizing the importance of the viticultural industry, the State Agricultural Society has made a separate department for viticulture, under the supervision of the State Viticultural Commission, and I have consented to act as superintendent of that department. As a great many cash premiums will be awarded at that fair, I would advise as many wine makers as possible to make exhibits.

*Work at Washington, D. C.*—Good work has been done, and is still being done, by our representative, Mr. Chas. A. Wetmore, at Washington, D. C., in behalf of the viticultural industry. The tariff on wines has been so amended that it is now perfectly satisfactory to all interested. The amendments to the internal revenue regulations, allowing the bottling of brandies in bond and the blending of brandies in bond, are now being urged by Mr. Wetmore, with the chances in favor of their being adopted. This work at Washington has been one of the principal efforts of this Commission during the past year, and will result in great good to the industry.

C. J. WETMORE,  
Chief Executive Officer.

## REPORTS OF COMMISSIONERS—1894.

## REPORT OF H. W. CRABB,

Commissioner for the Napa District.

OAKVILLE, CAL., June 12, 1894.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: It would give me great pleasure indeed to be able to state that the vines in Napa County were as healthy and vigorous as they were ten years ago, and that the crops they produced would command \$25 per ton at the wineries, as they did in 1884. But ever since then the price has steadily declined, till they only brought \$8 per ton in 1893, with the prospect of not bringing more than that in 1894. This condition of prices will compel people to uproot their vineyards and cultivate the land to other crops. The principal causes are overproduction, mismanagement, and the great financial depression that has lowered the prices of almost everything below the cost of production. Considering that wine is a luxury—not a necessity—the industry is not suffering more than some others; as soon as times are better, it will be one of the first to revive, and those who have resistant vineyards will in the near future get profitable returns. In a few years, if people stop planting, there will be only left in the county the 1,500 acres of resistants now planted. Fully one half of the vineyards between Rutherford Station and the bay have been destroyed by the phylloxera. Those still remaining are more or less infested. The great destruction in this section was owing to overproduction, caused by long pruning. Vines cannot, for any great length of time, remain healthy and vigorous with the annual production of from six to twelve tons of fruit to the acre. The vineyards in the central portion of the valley are not infested to any great extent, and those in the upper end of the valley are almost entirely exempt. There are about 1,500 acres planted to resistant vines; only about one half of those are grafted. The Riparia is considered the best, is easily rooted, and unites readily in grafting; the Rupestris suckers too badly; the Berlandieri is even more difficult to root than the Lenoir; the Solonis is equal, if not superior, to the Riparia; the Lenoir is often sunburnt, so that it can only be grafted below the surface. The resisting power of the Lenoir, as compared with the Riparia and Solonis, is as 13 is to 20.

I am propagating a vine discovered by Mr. Rampandahl in the head of a cañon in the mountains. Its appearance indicates that it is a true Riparia, and of gigantic growth, being more than twice as large as the Riparia, striking roots as readily as any *vinifera*. I grafted them late, yet some of them have made canes half an inch in diameter and five feet long. I have no doubt that it is resistant, and that it will be a valuable acquisition.

The imported hybrid vines I planted last year for the Commission are growing finely, and showing considerable fruit. The thirty-five

varieties of resistant hybrids imported by the Commission this year were also planted in their experimental plot, and are making a fine growth. I expect that some of these varieties will be of inestimable value to the State, as the expense of grafting will not have to be incurred. The new vineyards will contain only the best approved varieties—the harsh Zinfandel will then be a thing of the past, and California wines will attain a world-wide reputation.

The number of gallons of wine returned to the Assessor for 1893 amounted to 3,500,000. The returns for 1894 will approximate 4,000,000. At present there is more wine in the county than there was at this time last year. The quantity of brandy in the St. Helena bonded warehouse on May 31, 1893, was 62,348 gallons; on May 31, 1894, was 75,787 gallons.

Collector Waverley Stairley, of the Fourth District of California, informs me that there were produced in Napa County for 1893, 122,044 gallons of sweet wines and 152,832 gallons of brandy.

The quality of the wines is steadily improving with the experience of the wine makers. The growers and producers must form unions before they can dictate prices. They need not expect that the merchants will join them, for their interest is to buy as cheaply as possible, and then undersell the producer, to prevent his becoming a competitor.

The late frost in May was not general, but still did considerable damage to the crop. It is too early to state what will be the *extent* of the crop.

#### SOLANO COUNTY.

Here the industry is much more varied than in Napa or Contra Costa. It virtually supplies the San Francisco market with table grapes during the earlier part of the season. It not only furnishes the first grapes for the Eastern market, but the shipments are continued during the season. The grapes are well ripened; of the finest quality, and stand transportation equal to any. The crop from hundreds of acres is cured for raisins, which are but little inferior to the best Fresno article. The grapes are picked and laid out on wooden trays between the rows, to cure in the sun. Hundreds of tons of wine grapes are shipped annually to the wineries at Sacramento and Napa. The remainder of the crop is worked up into wine and brandy at the local wineries.

The Cordelia Wine Co., in addition to their dry and sweet wines, manufacture a superior article of sherry, by the use of solar heat. It is entirely free from the caramel taste as developed by the use of fire heat or steam, where the wine is sweet, and the temperature carried too high and kept in the oven too long. A dry wine under the same circumstances will not acquire it. I believe it was a great mistake in the sweet wine law requiring four per cent of sugar, as a much more delicate article would be produced with only one, or possibly two, per cent. The wines are fortified to 22 per cent alcoholic strength, and placed in a thoroughly tight room with a glass roof, in which the temperature averages about 100°. In cold weather and when the days are cloudy, the temperature is maintained by the aid of a stove. It requires about one year's time to produce a good article.

The phylloxera has in some sections destroyed a good many vineyards, while in others it has not made its appearance.

Collector Waverley Stairley, of the Fourth District, informs me that



the production of sweet wine and brandy in Solano County in 1893 was as follows: Sweet wine, 76,178 gallons; brandy, 21,910 gallons.

CONTRA COSTA COUNTY.

This county contains a large area of the finest vineyard land in the State. The vineyards are in a very healthy and flourishing condition. I could not ascertain that any of them were infested with the phylloxera. But very few vines have been planted for the last three or four years. The products of the vineyards about Clayton are manufactured into wines and brandies. The vineyards in the Alhambra Valley are mostly table varieties, and are shipped to Eastern cities and San Francisco. A large portion of the remainder of the wine grapes are sold to the Italian gardeners in San Francisco and elsewhere, for wine purposes. There are only a few varieties in the county, and the number of gallons reported to the Assessors in 1892 was 184,000; in 1893, 175,000, and in 1894 will approximate 200,000 gallons. On account of the convenience of shipping, and at low rates of freight, growers were enabled to obtain from \$10 to \$14 per ton for the wine grapes sold to the Italians in San Francisco and elsewhere.

Respectfully submitted.

H. W. CRABB,  
Commissioner for the Napa District.

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REPORT OF GEORGE WEST,

Commissioner for the San Joaquin District.

STOCKTON, September 7, 1894.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: There is little of interest to report concerning the grape-growing industry in the San Joaquin Valley. Both the wine and raisin growers are confronted by depressed general conditions of trade and an overproduction of material.

The production of raisins increased to nearly 85,000,000 pounds in 1893, according to the best obtainable estimates, and the crop of 1894 will not vary materially from this figure. This is nearly, if not quite, double the production of 1890. This output would have been much greater but for the practical elimination of the second-crop Muscats from the raisin crop. Very large quantities of these second-crop grapes have been made into sweet wines and brandy, and are responsible in a great measure for the present demoralized condition of the wine market. It is safe to say that more than 10,000 tons of second-crop Muscats were used in wine making, and half as many in brandy making. This represents a large percentage of the entire wine output of the State and cuts a most important figure in the wine business of to-day. There is practically no limit to the amount of these second-crop grapes obtainable in the San Joaquin Valley, and as price and not quality regulates the American wine market, all branches of grape growing will feel the ill effect of this evil for some time to come. The price of grape brandy

will be regulated by the cost of making brandy from second-crop Muscats. Sweet Muscat wine will largely replace Angelica, Angelica grapes will be made into port, and port grapes into dry wines.

While I believe it will take some time for these conditions to regulate themselves, there has been practically no planting for several years, and I think that sooner or later production and consumption will equalize. Many vineyards are being abandoned, many are being uprooted, and many are dying from disease.

Had it not been for the diversion of the second-crop Muscats from raisin to wine making, the raisin markets would have been flooded with low-grade products, while the wine market would have been in a much better condition.

It was hoped at one time that an outlet for a considerable quantity of Muscats would be found in syrup made from grape must, but nothing seems to have been done in the matter.

From experiments made last year it was proved that grapes when fed to hogs would pay from \$6 to \$8 per ton. If such is the case practically, it would seem that large quantities could be used in this way.

It is to be hoped that a revival of trade will relieve the present distress among all California grape growers, and that a few years will see the business on a paying basis once more.

Respectfully submitted.

GEORGE WEST,  
Commissioner for the San Joaquin District.

#### REPORT OF E. C. BICHOWSKY,

Commissioner for the Los Angeles District.

SAN GABRIEL, August 18, 1894.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: I herewith submit the following biennial report as Commissioner for the Los Angeles District:

The vineyards in the counties embraced in my district may generally be said to be in much better condition than they were last year at this time, especially so as regards the Anaheim disease, which you know has done such enormous damage to vineyards in this section during the last ten years. We have had a very limited rainfall in our winter months, giving us thereby a greater number of dry months than in years which give us normal rains, and the dry months have generally been the ones which were supposed to be favorable to the spread of this malady. This cannot be said of it this year. From the best information which I could obtain by personal inspection and through correspondence, I have come to the conclusion that the disease has about run its course. There are here and there, however, a few sporadic cases, but the number of new cases, compared with those in former years, is so insignificant that unless especially looked for, it would not cause comment.

The vineyards as a whole in the San Gabriel Valley—the section which suffered so severely from the Anaheim disease—are now in fairly

good condition. A few isolated remnants of the Anaheim disease are scattered about, but no place has been observed, as far as I could learn, where this disease has attacked this year new vines, *i. e.*, those that have hitherto been entirely free from it. There are quite a number of old cases of affected vines, which send out puny little shoots during the spring of the year and then die. I have also noticed, within the past three years, that many stumps of diseased vines, which had been attacked during more recent years, are still making a more vigorous growth each year, and I should not be surprised to see many of these vines ultimately recover. Should this be the case, then the destroying power of the disease is decreasing from year to year. Heretofore a vine attacked one year would perhaps make a slight effort to sprout again the next, and then cease. On examining the vine it would be found dry throughout and dead. I have therefore concluded that the attacks of the disease are now less violent in their nature than they were some five years ago, and consequently less damaging in their effect. It looks reasonable to me at this time that the malady has about run its course here. However, this disease has been so full of surprises, and its nature so changeable, that I should not like to be understood as reporting its complete extinction, and that it would now be safe to plant vines of the Mission and Muscat varieties (these varieties, you will remember, were the most susceptible to the Anaheim disease, and generally succumbed to it) on lands which were once planted to these varieties of grape, with the expectation that they would not again be attacked. Vineyardists who have made plantings of these vines in vineyards where the disease at one time was most pronounced, now claim that the new plants set out by them are vigorous and entirely free from the least sign of Anaheim disease, and I am personally cognizant of a vineyard which has been extensively replanted during the last few years with Mission cuttings, and these are doing finely to-day. Quite a crop of grapes is expected to be harvested from them this season.

Outside of these replantings and experimental plantings no new vineyards have been set out, but on the contrary the vines on quite a number of acres have been uprooted, to devote the land to more profitable farming, owing to the low prices which grapes have realized during the last few years.

Owing to cold foggy weather in the summer of last year, and slight rainfall in July, in certain sections more or less mildew resulted; in other localities chlorosis did some damage; but these effects were entirely of a local character, and the general result was therefore a generous crop of grapes.

So far this year the vineyards in nearly all my district are reported to be in fair condition, and where taken care of and irrigated, the outlook, at present, is for a good crop of grapes, although the vintage promises to be late, unless we should have considerable warm weather to facilitate the ripening of the fruit.

I have had some reports of damages done to vineyards by cutworms during the spring of the year, and have recommended the use of a Paris green and bran mixture. The result obtained thereby in ridding the vines of these pests was generally satisfactory. To properly prepare it Mr. R. C. Allen, General Manager of the Sweetwater Fruit Company of Bonito, San Diego County, recommends using three pounds of Paris green to a sack of bran; mix while dry, and then moisten with water,



slightly; throw a little of this mixture at the base of each vine, and the cutworm will greedily devour it. The vines will soon be free from worms.

Respectfully submitted.

E. C. BICHOWSKY,  
Commissioner for the Los Angeles District.

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REPORT OF ALLEN TOWLE,

Commissioner for the El Dorado District.

TOWLE, July 20, 1894.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: Since the last report by my predecessor, the late George G. Blanchard, there has been but little change in the status of the wine makers, the brandy distillers, and the vineyardists of this district who grow the wine grape varieties.

Mr. Blanchard, before submitting his report, made a thorough canvass of the counties comprising the El Dorado District, and his observations were comprehensive in every particular.

While the wineries and distilleries of my district are as a rule smaller than those of the heavier producing sections in the bay counties, they are widely distributed. There is scarcely a mountain county but what has its vineyards and its wineries, supplying a good local trade. It must be remembered that in most of these counties there is a large population of foreign birth or origin, and their consumption of home-made wine is large per capita, giving market for the product of most of the vineyards and small wineries. Then, again, there are very considerable wineries in Marysville, in Nevada County, and in Placer County which ship to other than local markets.

I do not anticipate that there will be any considerable planting of new vineyards in the near future, to supply outside markets. The price of new wine in first hands is too low to preclude that, great as is the admitted desirability and adaptability of the foothills of the Sierra for producing excellent wine. I anticipate, rather, that the wine vineyardists and wineries in these counties will continue in the even tenor of their way, producing what is needed for the demands of their respective localities, and leaving it to counties favored with better transportation facilities to produce for the Eastern markets.

That the foothills are well adapted in every particular for producing excellent wines will, I think, be admitted by all, but the time does not appear propitious for any immediate development of these resources.

I have not succeeded in obtaining data from which to make an extended report as to raisins and table grapes. The table grapes are of great value and importance to the vineyardists wherever transportation is within easy reach. There were 130 carloads of table grapes shipped from Placer County alone last year.

Respectfully,

ALLEN TOWLE,  
Commissioner for the El Dorado District.

## REPORT OF R. D. STEPHENS,

Commissioner for the Sacramento District.

SACRAMENTO, July 26, 1894.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: The season of 1894 thus far has been very favorable to the grape crop in this section of the State. While it is true that there has been some damage done to Tokays by the heat and sun, yet it is small in comparison to what it has been during some seasons in the past, and the indications now are, owing to favorable weather conditions, that the table grapes will be of superior quality; in fact, all grapes are looking well.

In consideration of the fact that my fellow members of the Commission have given their time and attention to the wine-producing industry alone, which is a very proper thing for them to do, for the reason that that is where the interests of those whom they represent lie, and knowing that they have been thorough and sincere in their efforts to promote this interest, and successful to a great degree, I have concluded that I could not do better than to give some time and attention to the table grape product of this State. I believe that there are but few, comparatively speaking, who have anything like a definite idea as to the magnitude of table grape growing in California, and that there are many who desire information regarding this great interest. Therefore, with the object in view to supply this want, I have devoted much time and attention in obtaining such information concerning the same as the facilities at my command would permit, and I feel satisfied that the following statement, showing the shipments made during the season of 1893, closely approximates the actual amount of the crop thus disposed of:

Shipments of table grapes in 1893.....19,043,200 lbs.—952,160 single crates=1,002 carloads.

As to varieties, there was about 60 per cent Tokays and the balance were Muscats, Cornichons, Malagas, Emperors, Fontainebleaus, and some other varieties.

Yours, respectfully,

R. D. STEPHENS,  
Commissioner for the Sacramento District.

## REPORT OF I. DE TURK,

Commissioner for the Sonoma District.

SANTA ROSA, September 1, 1894.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: I herewith submit my report for the year 1894.

There is comparatively little to be added to the comprehensive report made to me, under your direction, by Mr. Allen B. Lemmon. But few if any vineyards have been set out, and only a few vineyardists, who have lost their vines through the phylloxera, have replanted resistants;

and on the other hand, others, becoming discouraged, have pulled out their vines. The acreage of vines in the county I should place at something over 20,000.

The phylloxera still continues its work. From Glen Ellen down the Sonoma Valley there are few if any vineyards not on resistant vines. The vineyards of the Los Guilicos Valley are badly affected and can last but a short time longer. A new center of infection, at Geyserville, threatens the vineyards in the northern portion of the county. It is a satisfaction to know that comprehensive instructions as to resistant vines—and particularly as to new and highly recommended hybrids from France—will soon be at the disposal of vineyardists who desire to replant.

The yield of wine in the vintage of 1893 was very large, and failing to receive remunerative prices in San Francisco, many more wine makers have gone into business shipping wine East on their own account, hoping to thus secure better returns. It appears to me that, in view of the failure of the grape growers and the wine makers to come to any agreement with the California Wine Association as to a scale of prices to be paid for five years more, wine makers will enter the shipping field as their resources will permit.

Respectfully,

I. DE TURK,  
Commissioner for the Sonoma District.



## REPORTS OF COMMISSIONERS—1893.

## REPORT OF CHARLES BUNDSCHU,

Commissioner for the San Francisco District.

SAN FRANCISCO, June 12, 1893.

*To the honorable the Board of State Viticultural Commissioners:*

GENTLEMEN: I herewith submit the following report of the condition of the vineyards in Alameda County, as obtained by Frank L. Fowler, Esq., under direction of myself. I also submit the report of the Secretary of the Board recapitulating the statistics obtained by Mr. Fowler. Respectfully submitted.

CHARLES BUNDSCHU,  
Commissioner for the San Francisco District.

LIVERMORE, ALAMEDA COUNTY, April 18, 1893.

*Hon. CHARLES BUNDSCHU, Commissioner for the San Francisco District,  
State Viticultural Commission:*

DEAR SIR: I herewith beg leave to submit for your consideration the result of my labors in preparing statistical information relative to the vineyards in Alameda County. I have been most careful in gathering these viticultural facts and figures, and, as such, you will find them entirely reliable.

In addition to them I wish to present to your attention other and more general information that came to my knowledge.

I find throughout the county that with but few exceptions the vineyards have been most carefully handled, and given thorough cultivation, good pruning, and training.

Many vintners seem most anxious to improve their product by grafting the higher types of grapes on their more common stocks. There is an intelligent endeavor to experiment and improve upon the methods of making wine, and it seems to be the ambition of the wine makers to establish brands of their own. This I consider to be one of the most hopeful and cheering promises of future prosperity to the industry.

The districts are as follows: Livermore, Pleasanton, Suñol, Vallecitos, Mission San José, Warm Springs, Niles, and Haywards.

## LIVERMORE VALLEY.

In the Livermore Valley, I am pleased to say I have been unable to find any indication of the presence of the dreadful pest, phylloxera. Great care has been taken from the first planting of vineyards in 1881 that no cuttings or roots should be introduced from an infected district

without first being thoroughly disinfected. This precaution was almost universal, whether the stock came from a known infected region or not. It was the members of the honorable Commission of which you are a member that urged upon the vine planters the necessity of this precautionary course, and to-day the Livermore Valley vineyard owners congratulate themselves on their freedom from the disease, and feel grateful to the Commission for their wise forethought.

The general character of the soil is a sandy loam, and in places mixed with gravel, varying in color from red to black; deep and fairly rich. The growth of the vines is rapid and strong, but with few exceptions the crops are not heavy—the bunches and berries being generally small. The theory is that during the summer season the evaporation caused by the warmth of the sun is not counterbalanced by damp or foggy nights, as occur in many other grape sections. However, it is claimed by many that this has the effect of producing a higher quality of grape for wine making.

The crop of the season of 1892 was light, owing to severe frosts that came at a time when the vines were in bloom. The upland and mountainous sections escaped without injury, but the low-lying vineyards suffered severely. It is thought that at least one third of the crop was destroyed.

There was sufficient cellar capacity to accommodate the crop, but no surplus. If the valley has a full crop this year—and at date everything points to a large yield—the present cellars will be inadequate to handle it.

There is an excellent business opportunity for a large public winery that would pay the investors well.

The indications are that before the next vintage the cooperage will be mostly empty.

There have been about 300 acres of vines dug up this season by disappointed vineyard owners, but the great proportion of grape growers are sanguine that much better prices will prevail hereafter.

#### MISSION SAN JOSÉ.

In the Mission San José district I find that the phylloxera has gained a foothold, and the viticulturists are taking radical precautions to check its spread. In the vineyards where its presence has been discovered the vines in and around the infected spot have been destroyed and gas lime applied at once. I found a reluctance on the part of the owners of infected vineyards to give me information.

The grape output in 1892 was satisfactory so far as crop returns go, but like the balance of the vintners in the State, all are looking forward with hungry eyes and empty pockets to better prices for grapes and wines.

The cellarage capacity seems ample to accommodate the coming crop.

#### WARM SPRINGS.

In this district I did not learn of any vineyard infected with phylloxera. In every other particular its soil, climate, and conditions are similar to the Mission San José district.

## OTHER DISTRICTS.

The Suñol and Vallecitos vineyard plantations are small and few in number, and are entirely healthy. The soil is different grades of loam, and gravel mixed with loam. There are no wineries in either section.

At Haywards I find but few vineyards, and very small plantings are the rule. The vineyards are nearly all planted to table grapes, which are largely sold locally and shipped to San Francisco. Most of the vineyards are owned by Portuguese, and each owner makes enough wine for his own use.

There has been but little planting of vines in Alameda County during the last few years. Nearly all the vineyards are in full bearing. I should judge that the acreage of new vineyards planted during the last three years does not exceed two hundred acres.

During my visits to the different vineyards I find almost invariably that where the owner of a vineyard is a foreigner he makes enough wine for his home use, *and he uses it*. This is not true of the American-born owner. When the wine bottle on the home table of our people takes the place of the whisky and beer bottles on the saloon counters, we will have advanced one great step in the pathway of civilization.

I am most respectfully yours,

FRANK L. FOWLER.

SAN FRANCISCO, May 17, 1893.

CHARLES BUNDSCHU, *Esq., Viticultural Commissioner for the San Francisco District, San Francisco:*

DEAR SIR: At your request I have prepared a summary of the figures and statistics secured in the recent canvass of Alameda County, made under your direction. The county was divided into several districts for the mere intelligent grouping of the statistics.

The recapitulation of the total is as follows:

ALAMEDA COUNTY.	
Total number of vineyards .....	214.
Total acreage in vines .....	7,083 $\frac{1}{4}$ acres.
Total acreage in bearing .....	6,879 $\frac{1}{4}$ acres.
Acreage in wine grapes .....	6,690 $\frac{1}{4}$ acres.
Acreage in table grapes .....	295 acres.
Acreage in raisin grapes .....	98 acres.
Planted to resistants, 688 $\frac{1}{4}$ acres, as follows: {	
Riparia .....	484 $\frac{1}{4}$ acres.
Rupestris .....	8 acres.
Lenoir .....	2 acres.
Other varieties .....	194 acres.
Planted to resistants (same as above), 688 $\frac{1}{4}$ {	
acres .....	Grafted and in bearing .....
	663 $\frac{1}{4}$ acres.
	Grafted but not bearing .....
	0 acres.
	Not yet grafted .....
	25 acres.
Crop in 1892 .....	12,060 tons.
Stock of wine on hand .....	2,034,550 gallons.
Cooperage .....	4,147,150 gallons {
	Oak .....
	1,880,500 gallons.
	Redwood .....

The vineyards are distributed as follows:

LIVERMORE.	
Number of vineyards .....	100.
Acreage in vines .....	3,619 $\frac{3}{4}$ acres.
Acreage in bearing .....	3,558 $\frac{3}{4}$ acres.
Acreage in wine grapes .....	3,491 $\frac{3}{4}$ acres.
Acreage in table grapes .....	72 $\frac{1}{2}$ acres.



Acreage in raisin grapes.....	55½ acres.
Planted to resistants, 170¼ acres, as follows: {	Riparia ..... 131¼ acres.
	Lenoir ..... 2 acres.
	Other varieties..... 37 acres.
Planted to resistants (same as above), 170¼ acres—Grafted and in bearing.....	170¼ acres.
Crop in 1892.....	5,512 tons.
Stock of wine on hand.....	754,700 gallons.
Cooperage..... 1,397,900 gallons {	Oak ..... 369,400 gallons.
	Redwood ..... 1,028,500 gallons.

## VALLECITOS.

Number of vineyards.....	3.
Acreage in vines.....	3½ acres.
Acreage in bearing.....	3½ acres.
Acreage in wine grapes.....	None.
Acreage in table grapes.....	3½ acres.
Acreage in raisin grapes.....	None.
Planted to resistants.....	None.
Crop in 1892.....	5½ tons.

## SUÑOL.

Number of vineyards.....	14.
Acreage in vines.....	148½ acres.
Acreage in bearing.....	138½ acres.
Acreage in wine grapes.....	123½ acres.
Acreage in table grapes.....	25 acres.
Acreage in raisin grapes.....	None.
Planted to resistants.....	None.
Crop in 1892.....	229½ tons.
Stock of wine on hand.....	15,200 gallons.
Cooperage ..... 25,000 gallons {	Oak ..... 16,000 gallons.
	Redwood ..... 9,000 gallons.

## PLEASANTON.

Number of vineyards.....	21.
Acreage in vines.....	648 acres.
Acreage in bearing.....	574 acres.
Acreage in wine grapes.....	603½ acres.
Acreage in table grapes.....	44 acres.
Acreage in raisin grapes.....	½ acre.
Planted to resistants.....	None.
Crop in 1892.....	1,357½ tons.
Stock of wine on hand.....	7,400 gallons.
Cooperage ..... 12,650 gallons {	Oak ..... 7,850 gallons.
	Redwood ..... 4,800 gallons.

## NILES.

Number of vineyards.....	9.
Acreage in vines.....	148 acres.
Acreage in bearing.....	148 acres.
Acreage in wine grapes.....	77 acres.
Acreage in table grapes.....	37 acres.
Acreage in raisin grapes.....	34 acres.
Planted to resistants.....	None.
Crop in 1892.....	431½ tons.
Stock of wine on hand.....	500 gallons.
Cooperage ..... 2,000 gallons {	Oak ..... 1,000 gallons.
	Redwood ..... 1,000 gallons.

## MISSION SAN JOSÉ.

Number of vineyards.....	32.
Acreage in vines.....	1,564½ acres.
Acreage in bearing.....	1,503½ acres.
Acreage in wine grapes.....	1,553½ acres.
Acreage in table grapes.....	11 acres.
Acreage in raisin grapes.....	None.
Planted to resistants, 515 acres, as follows: {	Riparia ..... 353 acres.
	Rupestris ..... 8 acres.
	Other varieties..... 154 acres.
Planted to resistants (same as above) 515 acres.....	Grafted and in bearing..... 490 acres.
	Not yet grafted..... 25 acres.
Crop in 1892.....	2,853 tons.
Stock of wine on hand.....	911,000 gallons.
Cooperage..... 2,176,600 gallons {	Oak ..... 1,501,900 gallons.
	Redwood ..... 674,700 gallons.

## HAYWARDS.

Number of vineyards .....	26.
Acreage of vines .....	68 acres.
Acreage in bearing .....	63 acres.
Acreage in wine grapes .....	15½ acres.
Acreage in table grapes .....	52½ acres.
Acreage in raisin grapes .....	None.
Planted to resistants .....	None.
Crop in 1892 .....	151 tons.

## WARM SPRINGS.

Number of vineyards .....	18.
Acreage in vines .....	885 acres.
Acreage in bearing .....	885 acres.
Acreage in wine grapes .....	838 acres.
Acreage in table grapes .....	39½ acres.
Acreage in raisin grapes .....	8 acres.
Planted to resistants .....	3 acres.
Planted to resistants (same as above), 3 acres—Grafted and in bearing .....	3 acres.
Crop in 1892 .....	1,520 tons.
Stock of wine on hand .....	345,750 gallons.
Cooperage .....	534,800 gallons
<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <div style="display: flex; align-items: center;"> <div style="font-size: 2em; margin-right: 10px;">{</div> <div> Oak ..... 371,400 gallons.  Redwood ..... 163,400 gallons. </div> </div> </div> </div>	

Trusting the foregoing is satisfactory, I am very truly yours,

WINFIELD SCOTT.

## REPORT OF I. DE TURK,

Commissioner for the Sonoma District.

SANTA ROSA, June 30, 1893.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: I herewith submit the report of Allen B. Lemmon, Esq., on the condition of the vineyards of Sonoma County, and the census of the same, as obtained by him under my direction, together with the report of Winfield Scott, Secretary, on the scope of the work and the recapitulation of the figures obtained.

Respectfully submitted.

I. DE TURK,

Commissioner for the Sonoma District.

SAN FRANCISCO, June 30, 1893.

*Hon. I. DE TURK, Commissioner for the Sonoma District:*

SIR: At your request I have prepared a recapitulation of the census of Sonoma County made under your direction:

## TOTAL IN SONOMA COUNTY.

Total number of vineyards .....	832.
Total acreage in vines .....	23,291½ acres.
Acreage in bearing .....	21,908½ acres.
Acreage in wine grapes .....	22,613 acres.
Acreage in table grapes .....	664½ acres.
Acreage in raisin grapes .....	14 acres.
Infested by phylloxera .....	801 acres.
Same good for but one crop more .....	328 acres.

Planted to resistants.....2,328½ acres	{	Riparia.....	278 acres.
		Rupestris.....	None.
		Lenoir.....	289 acres.
		Other.....	136 acres.
		Variety not named.....	Balance.
Planted to resistants.....2,328½ acres	{	Grafted and bearing.....	684½ acres.
		Grafted but not bearing.....	108 acres.
		Not yet grafted.....	9 acres.
		Not reported.....	Balance.
Crop in 1892.....			48,409¾ tons.
Cooperage.....7,676,300 gallons	{	Oak.....	2,595,000 gallons.
		Redwood.....	5,081,300 gallons.

The recapitulation of the districts in the county is as follows:

#### FIRST DISTRICT.

*Comprising Vallejo and Sonoma Townships.*

Comprising Vallejo and Sonoma Townships.	
Number of vineyards.....	136.
Total acreage in vines.....	5,535½ acres.
Acreage in bearing.....	4,942½ acres.
Acreage in wine grapes.....	5,182½ acres.
Acreage in table grapes.....	353 acres.
Infested by phylloxera.....	782 acres.
Same good for only one more crop.....	323 acres.
Planted to resistants.....1,186 acres	{ Riparia.....265 acres.
	{ Rupestris.....None.
	{ Lenoir.....259 acres.
	{ Other varieties.....136 acres.
	{ Unspecified.....526 acres.
Planted to resistants.....1,186 acres	{ Grafted and in bearing.....550 acres.
	{ Grafted but not in bearing.....108 acres.
	{ Not grafted.....48 acres.
	{ Unspecified.....Balance.
Crop in 1892.....	5,870¼ tons.
Cooperage.....2,840,000 gallons	{ Oak.....877,000 gallons.
	{ Redwood.....1,963,000 gallons.

#### SECOND DISTRICT.

*Comprising Analy and Petaluma Townships.*

Number of vineyards.....	97.
Total acreage in vines.....	1,869 acres.
Acreage in bearing.....	1,841 acres.
Acreage in wine grapes.....	835½ acres.
Acreage in table grapes.....	32½ acres.
Acreage in raisins.....	1 acre.
Crop in 1892.....	5,000 tons.
Cooperage.....267,050 gallons	{Oak.....42,050 gallons.
	{Redwood.....225,000 gallons.

#### THIRD DISTRICT.

*Comprising Santa Rosa and Russian River Townships.*

Number of vineyards.....	384.
Total acreage in vines.....	7,894 acres.
Acreage in bearing.....	7,406 acres.
Acreage in wine grapes.....	7,745½ acres.
Acreage in table grapes.....	148½ acres.
Infested by phylloxera.....	18 acres.
Planted to resistants (not specified).....	6 acres.
Crop in 1892.....	16,572½ tons.
Cooperage.....1,663,300 gallons	{Oak.....800,800 gallons.
	{Redwood.....862,500 gallons.

#### FOURTH DISTRICT.

*Comprising Cloverdale, Mendocino, Knights Valley, and Washington.*

Number of vineyards.....	282.
Total acreage in grapes.....	7,241 acres.
Acreage in bearing.....	6,987 acres.
Acreage in wine grapes.....	7,105½ acres.
Acreage in table grapes.....	123½ acres.
Acreage in raisin grapes.....	12 acres.



Infested by phylloxera	.....	1 acre.
Planted to resistants	.....136½ acres	{ Riparia .....13 acres.
		{ Rupestris .....None.
		{ Lenoir .....30½ acres.
		{ Unspecified .....Balance.
Planted to resistants	.....136½ acres	{ Grafted and bearing .....134½ acres.
		{ Grafted but not bearing .....None.
		{ Not yet grafted .....2 acres.
Crop in 1892	.....	19,327 tons.
Cooperage	.....2,260,500 gallons	{ Oak .....398,200 gallons.
		{ Redwood .....1,862,300 gallons.

## FIFTH DISTRICT.

*Comprising the Townships of Bodega, Ocean, Redwood, and Salt Point.*

Number of vineyards	.....	33.
Total acreage in vines	.....	752 acres.
Acreage in bearing	.....	732 acres.
Acreage in wine grapes	.....	744 acres.
Acreage in table grapes	.....	7 acres.
Acreage in raisin grapes	.....	1 acre.
Crop in 1892	.....	1,640 tons.
Cooperage	.....646,450 gallons	{ Oak .....476,950 gallons.
		{ Redwood .....169,500 gallons.

Respectfully submitted.

WINFIELD SCOTT,  
Secretary.

SANTA ROSA, CAL., June 20, 1893.

*Hon. I. DE TURK, Viticultural Commissioner for the Sonoma District:*

DEAR SIR: Herewith I submit my report of the canvass of Sonoma County in the collection of vineyard and wine statistics, as per blank forms furnished by you for such purpose.

In doing this work, I first sent a circular letter to all vineyardists, with a blank form and addressed stamped envelope for the reply, asking for the desired information. This was preliminary to the general visitation of the county, and thus I secured a showing from about two hundred vineyardists. This was followed by visitation to every neighborhood and to almost every vineyard.

The statistics have been collected and classified by supervisor districts, of which there are five. After careful study of the county, this seemed to me to be the most satisfactory division of the territory. The first district includes the Sonoma Valley, in which phylloxera has done the greatest damage, with some contiguous country. The vineyards about Sebastopol, in Analy township, and the few vineyards about Petaluma constitute the second district. The third district is composed of Santa Rosa and Russian River townships; the fourth of the Healdsburg country and the territory north and east of there, and the fifth the coast region of the county.

Much attention has been given to the vineyards infested by phylloxera. In some instances the patience of the owners has been wearied by the questions asked. It was ascertained that in some instances high fertilization and very thorough cultivation were tried, but the ravages of the disease continued just the same. One or two flooded their vineyards with water, where it could be done, but this did not tend to check the deadly work of the disease. Bisulphide of carbon was tried, but it proved too expensive, and is not known to have done much good. Such

efforts to save vineyards were exceptional cases. Most grape growers have made no effort whatever at special treatment, either digging out the infested vineyard and planting the ground to something else, or replanting with resistants as the old vines have died.

From the best information obtainable, I conclude that the first appearance of phylloxera in this county was in the Dresel-Gundlach vineyard, a few miles south of Sonoma, in 1874 or 1875. There, much money was expended on suggested remedies and in experimenting with resistants. In time all the old vines were destroyed and resistants took their place, and the vineyard is now in a very flourishing condition.

From this old and noted vineyard the phylloxera has extended north some twenty miles. At Glen Ellen, it crossed over into Bennett Valley some five or six years ago, through which it has entered northward several miles. Three years ago the disease made its appearance in the Upper Russian River Valley, in the vineyards of L. G. Ellis and C. P. Moore. These vineyards are about three miles apart, and the river flows between them. Mr. Ellis can offer no explanation for the appearance of the insects in his vineyard, unless it was brought there with some cuttings received from a district in which phylloxera has since shown itself. Mr. Moore shipped some of his grapes to a winery in an infested district a few years ago, and he thinks the troublesome insect may have been carried to his home in the boxes returned. There are one or two other vineyards in the neighborhood of that of Mr. Moore in which a considerable number of vines have died, but the owners attribute the loss to other causes.

The work of destruction is very apparent in the extensive vineyard owned by J. G. Fair in Vallejo township. One field of nearly forty acres is badly infested, and a single spot of a few rods square was found in a neighboring vineyard.

In all other sections of the county the vines were found to be healthy, except an occasional touch of black knot. The people owning vineyards on the deep, sandy loam that predominates in Analy township are quite hopeful that vines in soil of that character are safe from attacks of phylloxera, but those cultivating the heavier loams do not speak with as much confidence. Within a few days, men who pronounced their vines healthy two months ago have reported the recent appearance of phylloxera in their vineyards.

In the Sonoma Valley a considerable number of resistant vineyards have been planted, but many old vineyards have disappeared and their owners have abandoned the culture of the grape. In other portions of the county there is much talk of turning attention to other crops. Grape growers are generally much discouraged—some on account of the ravages of the phylloxera, and others at the low prices which have long prevailed. While a few have added somewhat to their vineyards and are hoping that the day is not distant when grape growing will be again profitable, the greater number are discouraged.

As will be seen by examination of the detailed report submitted, many more *Riparia* have been planted than any other of the resistant variety. While these vines are slower growers than some others, they are generally regarded as the most reliable. As most of the resistant vineyards are young, just coming into bearing, it has not been possible to get much information in regard to results. At the same time, it may be said that

there is great confidence that resistant vineyards will be permanent, and that in the near future they are likely to be profitable.

In attempting to grow resistant vineyards, there have been some mistakes in grafting. It will not do to graft too low. If this is done the grafts are likely to throw out roots, and in time take the place of the resistant root. This is followed by phylloxera killing the vine, and thus all the work and expense have been for naught. It seems settled that the graft should be put in at about the surface of the ground. There is difference of opinion as to the kind of grafting best to apply to the grape, as will be seen by examination of the remarks of some of the vineyardists.

While phylloxera has done great harm in portions of this county, it is gratifying to note the many large and important districts in which the vines are still healthy and give promise of good returns. In journeying about the county, not nearly as many infested vineyards were found as had been reported. With great valleys as well as large areas of upland entirely free from phylloxera or other disease, after its existence in parts of the county for many years, it would seem likely that the prominence of this section for grape growing and wine making will long be maintained.

The increased acreage of table grapes is noted. Also, that this crop is usually quite profitable. There are a considerable number of such vineyards, and more are being planted every year.

While the report shows returns from 832 vineyards, aggregating 23,291½ acres, with a yield last year of 48,409¾ tons, there are many small vineyards of less than five acres which have not been reported. It is believed that there are at least one hundred of these, whose aggregate acreage is certainly 250.

The winery returns are not as complete as would be desirable, but the best has been done. Some wine makers have declined to give any figures, and others have made statements that were afterward found to be incorrect. In some instances two letters were written without getting any returns, and afterward, on visiting the winery, nobody was found there who was able to give the particulars asked for.

The collection of these statistics was not an unpleasant task. Most grape growers were found to be very reasonable and accommodating. After frankly talking the matter over with them, not more than a half dozen declined to answer the questions asked to the best of their ability. In doing this work the writer has had opportunity to meet in a friendly way and talk a few minutes with most of the men in this county engaged in this important industry. This has given me a knowledge of their business that could have been secured in no other way, and in submitting this report I return thanks to you for the favor you bestowed in permitting me to make this canvass.

Respectfully submitted.

ALLEN B. LEMMON.



## REPORT OF E. C. BICHOWSKY,

Commissioner for the Los Angeles District.

SAN GABRIEL, October 14, 1893.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: I herewith take pleasure in submitting to you the report of Professor Ethelbert Dowlen, on the counties of Los Angeles, Orange, San Bernardino, Riverside, and San Diego, together with a census and directory of vineyardists, as obtained by him.

Respectfully,

E. C. BICHOWSKY,  
Commissioner for the Los Angeles District.

SAN FRANCISCO, October 30, 1893.

*Hon. E. C. BICHOWSKY, Commissioner for the Los Angeles District:*

SIR: At your request I have prepared a recapitulation of the reports on vineyards, made under your direction. I have purposely omitted any recapitulation of the stocks of wine on hand, as the reports are difficult to obtain correctly, and the results are often misleading. The report on the crop in several districts, notably in Orange and Riverside Counties, is not complete.

The blank used in the southern counties was as follows:

.....	COUNTY.
.....	DISTRICT IN COUNTY.
Name and address .....	
Total acres in vines .....	
Acres in bearing .....	
Acres in wine grapes .....	
Acres in table grapes .....	
Acres in raisin grapes .....	
Acres planted season of 1892-3 .....	
Character of the soil of the vineyard .....	
How is the vineyard situated—lowlying, upland, or mountain? .....	
Crop in 1892 .....	
Stock of wine on hand, in gallons .....	
Total quantity of cooperage .....	gallons: { Oak cooperage .....
	{ Redwood cooperage .....
Remarks: .....	



## RIVERSIDE COUNTY.

District.	Total Acres in Vines	Acres in Bearing	Acres in Wine Grapes	Acres in Table Grapes	Acres in Raisin Grapes	Acres Planted in Season of 1892-3	Crop in 1892.
Dry Ranch	479	108	-----	2	477	22	4½ tons raisins.
Perris	30	5	-----	-----	30	10	½ ton grapes.
Rincon	170	170	-----	-----	170	-----	-----
Riverside	621	621	-----	-----	621	-----	377½ tons raisins.
South Riverside	51	48	23	-----	28	3	91 tons grapes.
Yorba	160	160	160	-----	-----	-----	50 tons grapes.
	1,511	1,112	183	2	1,326	35	141½ tons grapes. 382 tons raisins.

## SAN DIEGO COUNTY.

Alpine	46	46	12	-----	34	-----	10 tons grapes.
Bernard	15	10	-----	2	13	-----	13 tons raisins.
Buena	4	4	-----	-----	4	-----	5 tons raisins.
El Cajon	2,632	2,632	8	15	2,609	-----	78 tons grapes. 1,350 tons raisins.
Escondido	307¼	284¾	29	10	268¼	-----	169¼ tons raisins.
Fallbrook	10	10	-----	-----	10	-----	86 tons grapes.
Jamul	33	33	-----	-----	33	-----	10 tons raisins.
Lakeville	39	39	20	-----	19	-----	4 tons raisins.
Otay	227½	166½	152	1½	74	4	6½ tons raisins. 80 tons grapes.
Palm Valley	193	193	-----	8	185	-----	350 tons grapes.
Poway	338	332	-----	-----	338	6	60¼ tons raisins.
San Diego	29	29	-----	-----	29	-----	10 tons raisins.
San Marcos	28	28	20	-----	8	-----	40 tons grapes.
San Pasqual	35	23	-----	-----	35	11	40 tons grapes.
Sweetwater Valley	311	300	-----	11	300	-----	11 tons grapes.
Twin Oaks	94	94	73	-----	21	-----	207½ tons raisins.
Vista	82	67	67	-----	15	-----	12 tons raisins. 370 tons grapes.
	4,423¾	4,290¼	381	47½	3,995¼	21	63 tons grapes. 1,117 tons raisins. 1,858¾ tons raisins.

## GRAND TOTAL OF SOUTHERN COUNTIES.

Los Angeles	4,443½	4,091½	4,083½	38	322	282	9,996 tons grapes.
Orange	601½	363	99	12	490½	73	128 tons grapes.
Riverside	1,511	1,112	183	2	1,326	35	141½ tons grapes. 382 tons raisins.
San Bernardino	5,839½	5,198	1,595	5	4,239½	95	1,142¾ tons raisins.
San Diego	4,423¾	4,290¼	381	47½	3,995¼	21	4,928 tons grapes. 1,117 tons grapes. 1,858¾ tons raisins.
	16,819¼	15,054¾	6,341½	104½	10,373¼	506	16,310½ tons grapes. 3,383½ tons raisins.

Respectfully submitted.

WINFIELD SCOTT,  
Secretary.



SAN GABRIEL, October 9, 1893.

*Hon. E. C. BICHOWSKY, Commissioner Los Angeles District:*

SIR: Herewith I beg to hand the report of my visit to the vineyards of the Los Angeles district. The statistics have already been forwarded to San Francisco, and would have been sent in earlier only that many people were away from home, which has caused delay in obtaining the necessary information. In addition to this, there was a considerable area of newly planted vineyards to be gone over, which have all been set out since the issuing of the last edition of the directory. The long distances to be traveled by buggy have also greatly lengthened the time required to traverse the various districts.

The vineyards in the southern counties of the State are, on the whole, in a better condition than they were last year. In the early part of the year the vines looked better than they had done for the last five years. This better condition has been kept up in most places, though in some instances there has been a falling off, but generally speaking a better growth has been made and the promise of a larger crop has been fulfilled.

## ANAHEIM, OR CALIFORNIA DISEASE.

With respect to the Anaheim, or California disease, it is not easy to make any statement that may be fairly taken as definite. This disease remains as vexatious as ever, so far as cause and cure are concerned, but it appears to be slowly losing its deadly power. It also evidently starts a little later each year; in fact, it is now scarcely possible to make any reliable estimate of the amount of disease present in a district before November, whilst a few years ago its presence was fully declared by August, and the first symptoms were observable much earlier than that. This year the disease is present over a larger area perhaps than it was last year, but it does not appear to be doing so much injury. Here and there purely local conditions seemed to have favored a stronger attack, but on the whole it seems to be slowly decreasing in virulence. This is certainly the case in some places, where vines, which last year showed a considerable proportion of foliage having the usual yellow markings, have this year entirely recovered and are bearing a good crop of fruit. In the Santa Ana district also some vines were seen which were apparently quite healthy, although the original vineyard had been dug out some years since on account of disease; the ground since then has been regularly cropped with hay, but some of the old roots have regularly sent out a new growth, which has never yet shown any signs of sickness.

## VINES BEING TAKEN OUT.

In some districts, especially where citrus fruits can be cultivated with advantage, there is still an inclination to take out vines and replant with citrus fruits. Other growers have either already set out deciduous trees amongst the vines, or will do so this next season, whilst some will take out the vines entirely, claiming that the low prices ruling for grapes, whether dried or green, leave them no other course.

## NEW AREAS SET TO VINES.

In other districts considerable acreage has been newly set to vines, all of raisin varieties, within the last two years. Most of these new vineyard districts are in San Bernardino County, in the neighborhood of Rialto, Rochester, Bloomington, and the Dry Ranch districts. Part of this area is under irrigation, and part is not. The Dry Ranch district appears to have sufficient water without irrigation, as in August the soil was quite damp at a depth of from four to six inches from the surface. This, of course, was where the ground had been well cultivated. In all these newly planted-out districts the vines have made an exceedingly good start.

## SOILS.

It is a rather difficult matter to make any satisfactory classification of soils in the southern counties. Speaking broadly, all the varieties of soil, except in a very few districts, are derived from the decomposition of granitic rocks, yet the soil in a small area will vary from the lightest sand to stiff adobe. On the other hand, large areas often range only from light to moderately heavy loam, the transition being very gradual.

## SITUATION.

There are two districts which deserve special mention on account of their situation, viz: Hesperia, and what for the present may be called Antelope Valley district. These are both valley districts, yet their lowest points are between 2,000 feet and 3,000 feet above sea-level. Hesperia is a compact district, with a deep, rich soil, and a good supply of water. The soil is a red sandy loam derived from the decomposition of granitic rocks. The Antelope Valley district embraces points which are some forty miles apart from each other, Fairmont and Manzana being on the one side, Big Rock Creek, Myrtle, and Llano being on the other side, and Palmdale lying between. In these places also, the soil is deep and rich, and there is a good water supply in course of development. In each district the climate would seem to be specially adapted for drying fruits. Fogs are unknown; the nights, during the drying season, are warm, and the air is warm and dry.

## HEALTH OF VINEYARDS.

Last year a report was sent to the Commission that a vineyard in Escondido had been newly attacked by the vine disease. An investigation was made, and it was found that the vineyard in question was not in the Escondido Valley proper, but in a cañon running down from the valley. A visit was made to the same vineyard this year, and it was found that though there were still a number of vines diseased, the number was not so great as it was last year, nor were the vines so badly affected. Some of the vines appeared to have entirely recovered. On the other hand several fresh cases of attack were found in other districts, but as a rule the disease appears to be much less deadly than it was. In the Cucamonga district also the vines were found to be less affected than they were last year. In this connection it must be remembered that in San Diego, San Bernardino, and Riverside Counties the vines

have never suffered from disease to the extent that they have in some other districts.

The newly set out vineyards in Orange County have made an exceedingly good growth, and in many instances show no signs of disease; yet many other cases could be found where the first signs of disease could be easily seen, though here, as in other districts, the disease appears to have lost much of its former destructive power. But it is still too early to venture upon any statements on this subject.

In some districts there was a considerable amount of discouragement, owing to the low prices ruling for grapes, whether for wine or for raisins. In the El Cajon and Sweetwater Valley districts the growers have succeeded in establishing a reputation for their own district by united action in packing their crops. The greater number of growers have packed their crops together, and so established a brand for the district, which will be permanent, no matter how much the ownership of the vineyards may change. This arrangement has already brought about good results; in fact, the arrangement worked so well last year that operations will be carried on on a much larger scale this season. It would probably be well for growers in other districts to adopt some such plan of united working as that noticed above, and so not only bring more system into the grading and branding of their crops, but also at the same time secure for themselves better returns for their labor.

ETHELBERT DOWLEN.

The above report is indorsed, and submitted to the Commissioners.

E. C. BICHOWSKY,  
Commissioner for the Los Angeles District.



## REPORTS OF COMMISSIONERS—1892.

## REPORT OF E. C. BICHOWSKY,

Commissioner for the Los Angeles District.

SAN GABRIEL, October 27, 1892.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: On the morning of the 13th inst. appeared an article in the "Los Angeles Times," announcing that the dreaded vine malady, known as the "Anaheim disease," had again appeared in the section from which it derived its name, after having apparently left it for a number of years, attributing its appearance at this time to planting of vines in soil heretofore set out in vines destroyed by the malady, and claiming that the contagious germs remained dormant in the ground until material was furnished them to prey upon. It will be remembered that this peculiar disease, which has played such sad havoc with one of the most prominent industries of Southern California, is said to have originated some years ago in that part of Los Angeles County which now constitutes Orange County, and destroying since then almost completely thousands of acres of vineyards in that and adjacent territory, leaving them bleak and desolate. After the vineyards had been cleared of the dead vines by uprooting same, and a crop of grain had been raised on them, it was determined, as an experiment, by a few former owners of vineyards, to replant this land again with grapevines, obtaining their cuttings from districts where the disease had not heretofore been observed. Those who had the courage to make the attempt at the end of the first year found apparent success crowning their efforts, for the young vines had passed through the trying time general to all plants, making a good growth, vigorous in appearance, and evidently free from all disease. Others, emboldened by the success of their neighbors, set out other small vineyards, and the prospects were indeed again favorable for the establishment of vineyards in this and other districts.

It was but recently I was informed, upon inquiry, that the young vineyards planted in Orange County were thriving. I was therefore greatly surprised to read the article announcing the reappearance of the disease in that section. Knowing that a number of parties in Orange and Los Angeles Counties, owing to the apparent departure of the disease, intended to plant vines largely this coming year, I determined to investigate the reports, and if I found the disease again appearing in a locality where it was reasonable to believe it had become extinct, it would be my duty to inform all those interested of this fact.

On the morning of the 25th inst. I left for Santa Ana, accompanied by Professor Ethelbert Dowlen, viticultural expert, whom I had requested to go with me on my tour of inspection. At Santa Ana we were met by

Mr. E. S. Wallace, a resident of that city, and author of the above-mentioned newspaper article, together with Professor Newton B. Pierce, Government pathologist. This latter gentleman is at present located in Santa Ana, and kindly accepted an invitation to join us. Ten vineyards were visited during the day, four of which were entirely free at that time from any signs of disease, while six showed the apparent baneful influence of the destroyer in a greater or less degree. In going to Santa Ana, my object was to inspect those vineyards which had been reputed to be contaminated with the malady, and *not* so much to inspect vineyards free from disease; therefore, while we saw evidences of disease in six out of ten inspected, it is not fair to assume that such a large proportion of all the vine-producing areas in that district are thus affected.

The first vineyard visited is located a short distance from the town of Orange. There are about ten acres of vines in this place, planted on coarse, gravelly soil, but from appearance of plants there must be sufficient loam underneath to force the growth to a remarkable degree. Considering that these vines are only six months old, runners measuring from six to ten feet in length are rather surprising for such young plants. A number of these vines also showed small bunches of grapes. No disease was visible here.

The next vineyard was a field of ten acres belonging to Mrs. Blaisdell. This property is about a mile from the first vineyard visited. Here the first evidence of disease was detected, and especially was it pronounced upon a ridge running through a portion of this field. The soil there was evidently much poorer in quality than that surrounding it. On inquiry we ascertained that the cuttings in this vineyard had been set out on land which had formerly borne vines killed by the disease. These cuttings were said to have been brought from Elsinore in February, 1892, at which time they were thought to have been entirely free from disease.

The next vineyard visited was located on the Tustin branch of the Southern Pacific, and is the property of a Mr. McPherson. This was found free from disease. The soil is gravelly, with dark, heavy loam. Cuttings were said to have been set out in the spring of 1890, and up to the present time had retained their full vigor.

The next vineyard inspected is on the Hughes ranch. The soil here is gravelly, with light, sandy loam, and the vines were free from disease. Just across the road from the former is another small vineyard, in which the vines are young, healthy, and vigorous. Just back of this vineyard is the property of Mr. Sitton; this is also free from disease.

The sixth vineyard examined contained vines from six months to two years old, in the larger portion of which evidences of the disease were discovered. Here we observed that the young vines were not infected as much as the older ones.

The seventh vineyard was the property of C. B. Pulver. Here the disease was more marked than upon any other vines heretofore examined. The cuttings were obtained from Etiwanda, and were supposed to have been free from any infectious disease. They were set out in the spring of 1891.

The eighth vineyard visited adjoins the Santa Ana cemetery. The cuttings from which this vineyard was planted were also obtained from Etiwanda in the spring of 1890, and were believed to have been free from disease. Through this vineyard, as in one already mentioned, a slight elevation in the soil runs from north to south. The vines on this

show the signs of the disease more marked than those surrounding it on lower ground. When mentioning this to the owner, he explained that in his opinion the lack of vigor in these vines was due to the fact that they had not, perhaps, received as much irrigation as the neighboring ones. This vineyard was said to have borne a good crop. A number of grapes which were picked from the vines, however, had the unmistakable flavor so common with fruit plucked from vines afflicted with the Anaheim disease.

The ninth vineyard is the property of Fred Rohrs. These cuttings also came from Etiwanda in the spring of 1890. Like all other cuttings from that neighborhood, they were supposed to have been free from all disease, but to-day the vineyard shows unmistakable signs of the malady.

The last vineyard inspected is the property of Mr. Nisson. It contains only about two acres. The cuttings with which this small tract was planted, Mr. Nisson informed us, were obtained from San José in the year 1891. This vineyard, like some of the others, was planted where diseased vines were taken up in the winters of 1888 and 1889. Professor Pierce, who has made a study of this particular tract, had written to San José, where the cuttings were obtained, to ascertain whether any disease had made its appearance there. He was informed that no disease of the character described by him had shown itself in that valley, and to make their statement positive they sent him leaves from the identical vines which furnished cuttings for Mr. Nisson's vineyard. The leaves were perfectly green, being free from that spotted character so peculiar to the disease.

In four of the six infected vineyards inspected, it will be noticed that the cuttings in each were obtained from Etiwanda, in San Bernardino County, a district which, at the time of securing these cuttings, was free from disease, but which, in the past eight months, is said to have developed it. Therefore, if such is true, it cannot be positively stated that the disease was not in the cuttings, but lurking in the soil. While in the case of Mr. Nisson, we have positive evidence that the grape cuttings which he secured from San José came from healthy stock; here, apparently, is a case where the "impregnated ground" theory may hold good. The vineyard of Mrs. Blaisdell contains cuttings obtained from Elsinore. In this district, I have been lately told, exists a disease almost identical in its most visible features with the Anaheim disease, differing from that, however, in this essential: that the plant does not die from it.

I might add an experience, which has come under my personal observation, in the Sunny Slope vineyards located in the San Gabriel Valley: During the height of the disease in this vineyard, a large plot of Mataro vines had every appearance, as far as outward signs would indicate, of a very severe attack of the Anaheim disease, so much so that it was considered lost; but contrary to all expectations, the following year the vines made some new growth of better color than usually made by diseased vines; this continued to increase as the season advanced. I have watched this particular plot—as I have been in a position to do so—with a great deal of interest, and can state that to-day there is not a healthier lot of vines of that variety in the valley. The fruit this year was perfect in shape, full grown, and sweet, and a good crop was produced. None of the so-called patent remedies of any kind were used to bring this result about, only good cultivation and irrigation were given,



and the balance was accomplished by nature. This is a very rare case; in fact, it is the only one known to me where the disease acted in this most peculiar way. The usual result to an attacked vine was death.

It therefore seems to me, through the inspection made, that the attack being of such recent date, it will be impossible at this time to positively state that the malady which we diagnosed as the Anaheim disease is such, or something very similar in appearance to it; however, disease is apparent there, but whether it is the fatal Anaheim disease, is a question which time alone can answer. All vineyards inspected were planted with Muscat cuttings.

In the valley in which I reside—the San Gabriel Valley—the fatal Anaheim disease to all appearances has ceased its virulence, attacking very few vines this year which had hitherto been free from it; but in the face of the former symptoms observed in the birthplace of the disease, as above set forth, it would be well for those intending to set out large bodies of vines, to go slowly for the next year, and await development in the infected districts, as it is a question whether the disease has run its final course.

Before closing, I desire to express my thanks to Professor Dowlen, Mr. Wallace, and Professor Pierce for valuable information received and courtesies extended.

Respectfully submitted.

E. C. BICHOWSKY,  
Commissioner for the Los Angeles District.

## PARTIAL REPORT OF CHARLES A. WETMORE.

Read at the December meeting of the Board, 1893.

NEW YORK, December 3, 1893.

*To the Board of State Viticultural Commissioners of California:*

GENTLEMEN: While awaiting the final results of examinations of California wines and brandies exhibited at the World's Columbian Exposition, I have devoted some time in New York to the question of the practicability of a wine exhibit here, with café and restaurant facilities. In this latter matter, I believe I have succeeded in securing all that our State could ask for, but the plan is not yet perfected sufficiently for final submission.

## THE OLDHAM REPORT.

The report to the British Royal Commission on California wines and brandies, made by Charles F. Oldham, of London, has been printed in full by all the leading wine trade reviews of this country, and will no doubt prove to be the first important step toward unprejudiced critical recognition of the varying merits and improving conditions, as well as the shortcomings of our vintages. As soon as the general wine trade accepts California products, subject to distinctions of quality and vintages, the grower who aims at quality will have a chance to rise in the market above the dead provincial level.

Under the arrangement which was made with the British Royal Commission, the report of Mr. Oldham was to be a public matter, to be followed by the transmission to the Royal Commission in London through him of samples of such wines and brandies as he might select for further and more practically effective examination and demonstration. If "the proof of the pudding is in the eating," the proof of Mr. Oldham's criticisms will be in the future sampling in London.

It was my understanding with Mr. Oldham that samples, in liberal quantities, of all the wines and brandies specially designated in his report, should be collected by the State Viticultural Commission and forwarded at the expense of the State to him. This should be done without any unnecessary delay. The expense of transportation and the British duties will not be a very great item.

There are some directions which will need to be carefully attended to: First, let it be borne in mind as to this shipment, and as to any other that our producers may contemplate, that, under a recent law, the regulations of the British customs service are a Chinese wall against any goods which bear, according to British ideas, a false representation. For instance, Mr. Oldham informed me that a lot of wine shipped in barrels from Santa Clara County was stopped because the word "Burgundy" was on the heads. He was in doubt whether he could get them at all, even after offering to scrape the offending word from the wood.

It is assumed in England that "Burgundy" means a French wine, unless unmistakably described as "California Burgundy," notwithstanding the fact that the real signification of the term in a French sense is very vague. There is no telling what difficulties might arise from the popular mercantile use of general terms, such as "Hock," "Port," "Sherry," "Sauterne," and "Champagne." If the popular term, "Burgundy," causes difficulty, what might happen to a cask marked "Johannisberg," as is common with us in describing wine from the "Johannisberg Riesling"; or a "Tokay"?

Bearing this in mind, it would probably be best to put all samples in new, unstamped boxes, viz.: without proprietary brands; and to label bottles and mark cases with simply the names of exhibitors and distinctive terms after the following fashion: "California, wine from Riesling grapes"; or "from Sauternegrape varieties"; or "of Sauterne type." In all cases indicating the California origin in connection with all use of terms of foreign character. This work, to avoid any trouble, ought to be done by the Commission after the samples are gathered together.

As to the quantities of each kind to be sent, I respectfully suggest not less than a case of each kind; the more the better. The opportunity to get a general distribution, and perhaps repeated samplings in places difficult to approach ordinarily, will be worth all the trouble and expense.

Later I will make some suggestions as to the form of official publication for Mr. Oldham's report and general information properly connected with it.

Perhaps some may not appreciate the importance of simple, candid, unprejudiced, and conservative criticism, such as we have been favored with, and would have been better pleased with more positive laudation. To such let me suggest that the highest compliment will have been paid us, when the wine trade centers of the world think it worth while to ask for similar reports every year, for the practical information of the trade, the fact of distinctions—merits and defects—being assumed, instead of adhering to the old style, dead level classification under the one term "California."

A report on California wines is only a misleading agency, if it assumes to fix any permanent character, or relative value, upon any particular grower's brands. The wine trade of the world will not accept any final report upon distinctions which vary from year to year; nor will it indorse brands as synonymous with fixed qualities, except after long experience, and then only in a very general and elastic sense. The report from Chicago upon our bottled samples of varied, and in many cases unknown years, is a very good starter, and may be the means of establishing a custom for more particular yearly application. When that happens, we may be said to have won distinction and to command attention.

#### THE TARIFF ON WINES.

The supposition that there would be an attempt to lower the tariff of wines by the Ways and Means Committee in Congress, is now supplanted by the certainty that an attempt will be made to accomplish the same by a treaty with France.

I desire especially to avoid all appearance of volunteering any opinion concerning the attitude our producers should assume toward such a



movement. My present temporary connection with the work of the Commission does not call for opinions or advice in this matter, except that as an individual producer I shall claim that the policy of California must be voiced by the owners of vineyards rather than by the dealers and speculators in wines. The prosperity of the vine grower is the question of paramount importance.

It is, however, of first importance that the vine growers should be kept informed in all matters affecting this movement, which will undoubtedly be openly agitated before Congress convenes after the Christmas holidays.

The French, stimulated by a revival of production of wines and consequent low prices both in France and Algiers, have been diplomatically studying our tariff conditions and endeavoring to get a reduction of the rate on wines during the general revision under the Wilson bill.

This first movement has failed; however it may yet prosper through future amendments remains to be seen.

The pitiable condition of our producers and the low prices obtaining for better wines than France is trying to send us, have given rise to the suggestion of a compromise. In a rough way the plan suggested by the New York importers is outlined in a brief article in the last issue of "Bonfort's Wine and Spirit Circular," viz.: "If our friends in Bordeaux want to do something practical, let them form a syndicate to take five million gallons of California wine per annum for five years, provided the American duty on still wine is reduced to 25 cents per gallon (33 fr. per hecto.). The details can very easily be arranged by appointing—say M. Albert Schyler—to treat with the California State Committee on Viticulture in regard to quality, shipments, etc. If Bordeaux will send him, or anybody like him, we'll guarantee him against Indians, the Cataract of Niagara, and American whisky. He ought to be here by Christmas."

Whoever the Bordeaux people have had here recently appears not to have succeeded, nor to have been wise in his methods. The suggestion voiced through "Bonfort's" has been cabled to Bordeaux, and the result is made partially known by the following news dispatch, which appeared in the New York papers, viz.:

PARIS, Dec. 2.—The Bordeaux Society of Political Economy yesterday decided to ask the French Government to open negotiations with the American Government with a view to concluding a treaty of commerce between the two countries. The society begs the Senators and members of the Chamber of Deputies, representing the Department of the Gironde, to use their influence in behalf of the proposal.

We may assume that the agent of the Bordeaux wine men is on his way to our country, fully empowered to act for a syndicate.

In connection with these movements, the reports of the last vintage in Europe, and the market quotations for new wines, are interesting.

The French vintage for 1893 is estimated at thirteen hundred million gallons. This is about double what it was a few years ago, and almost equal to the average for the ten years prior to 1878.

There appears to be good reason to believe that the phylloxera plague has spent its force, and that it will now succumb to careful management.

The importations into France from Spain have begun to materially diminish. The increase of the French vintages, aided by the inventions which have been introduced during the period of scarcity, such as "second wines," made with cane sugar and pomace, and raisin wines,

makes it possible for the large exporters to think of increasing exportations, especially to those countries, like the United States, which have been educated to the taste of "cargo" wines (*vins de cargaison*).

By reference to "Bonfort's" European correspondence, published the 25th ult., it will be seen that new wines have been sold in all districts at very low prices, because cooperage was lacking.

In the Herault, light grade Aramon wines sold at 10 to 11 francs per hectoliter, or about 8 cents per gallon; superior quality Aramon, at 12 to 13 francs, or about 9½ to 10 cents per gallon; other superior wines, 15 to 17 francs, or 11½ to 12½ cents per gallon.

In Algiers, "good wines of 11 to 12 degrees" of alcohol "are worth from 7 to 10 francs per hectoliter" (7 to 8 cents per gallon), "and distillery wines 70 centimes per degree."

Considerable quantities of fair qualities of 1893 Medoc have been sold for from 25 to 30 cents per gallon.

France could easily use a good quantity of stout California wines, to be blended for re-exportation, thereby saving all duties, but whether she can pay enough to make it profitable to us is the question. Perhaps, as a compromise, she can.

There are several views of this tariff question, which may be taken seriously under consideration, with reference to our future prosperity, but I do not propose to be a volunteer in the coming fight. I leave the subject with a caution to the vine growers to take charge of their own interests.

I will write further concerning the café exhibit for New York in a few days.

CHAS. A. WETMORE.

## REPORT OF THE EXECUTIVE COMMITTEE.

Read at the June meeting of the Board, 1893.

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SAN FRANCISCO, May 16, 1893.

CHARLES BUNDSCHU, *Esq.*, *Chairman Executive Committee, San Francisco:*

DEAR SIR: At your request I have prepared the following statement of the principal work done by the Executive Committee during the past six months.

At the meeting of March 14th, the committee provided for the Commission's exhibit in the Horticultural Building at Chicago. The exhibit is now in place.

Under the direction of the committee, a pamphlet on viticulture in California has been prepared and is ready for publication.

A canvass of the counties of Sonoma, Santa Clara, Alameda, and Southern California, similar to that undertaken in Napa County, is under way. The Alameda County canvass is now ready for publication.

A conference was held in May with Hon. T. J. Geary, Congressman from the First District of California, as to needed revisions in the customs and internal revenue laws. This study has been made and drafts of laws prepared.

The committee had prepared a plan for a fine display of California wines in the California Building at Chicago. The State World's Fair Commission would not use it. The show is very inadequate, according to all reports.

In legislation the committee has indorsed the State Raisin Packers' Association bill; and the committee has investigated the proposed reciprocity scheme (of Commissioner Shorb) with France; it has also endeavored to get the Internal Revenue Department to issue a special tax-paid stamp for fruit brandy withdrawn from original packages.

The committee has continued the collection of statistics of coast movement of wine, and the Secretary has continued keeping up the statistics as to Eastern and foreign shipments.

By the time the Board meets, the committee will be ready to report on their quarters and the café.

Yours truly,

WINFIELD SCOTT.



## REPORTS OF SECRETARY WINFIELD SCOTT.

## FIRST REPORT.

SAN FRANCISCO, December 12, 1892.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: During the past six months the regular routine work of this office has been conducted as usual, and one or two special investigations ordered by your Executive Committee have been attended to as promptly as possible.

I have spent more time than ever in the collection of statistics. This branch of my work, which is specially enjoined upon me by the Act of 1880, has been systematized to such a point that not only can any desired statistics be obtained at a moment's notice, on the export movements of wine and brandy by sea and rail, but also on the imports of wines and spirits, the production of sweet wines, brandies, etc. I attend personally to this work, as experience has shown that the commercial reports in the daily press are too inaccurate to be depended upon.

The annual report for 1891-2 has been received from the State Printer, and properly distributed.

The special reports of Commissioners Shorb and Bichowsky on the Anaheim disease have been printed and properly distributed.

Your Executive Committee has authorized the preparation and publication of a pamphlet on the manufacture of grape syrup. This would have been issued by this time had I not been delayed by the Yaryan Machine Co., of Toledo, Ohio, which is preparing the cuts, etc., for the vacuum process. I am also informed that Messrs. Sanders & Co., of San Francisco, have invented a machine for making syrup by the vacuum pan process. I have myself investigated the open tub and pan processes in use at Cloverdale, Woodland, and elsewhere, and have received valuable assistance from the Western Sugar Refinery Company. My own part of the work is done, and I am now awaiting the reports from the Yaryan Co. and Sanders & Co., before sending the pamphlet to the State Printer. From present appearances there is not much prospect of issuing this pamphlet until after the Legislature adjourns, which will not be until March 1, 1893. This will, however, be in ample time for the purpose.

I am now tabulating, and preparing for publication in a separate pamphlet, the vineyard statistics of Napa County, prepared under direction of Commissioner Priber, at the instance of the Executive Committee. It will not require over two days to prepare the returns from these districts for the printer, and I expect to have the Napa Valley report with the State Printer by the end of this week. It must be published before the end of the month, to accomplish what is desired.

I have been actively engaged during the past month in watching the development of the attack on the Sweet Wine bill coming from New York. I have done much personal work, both with the members of the

present Congress and with the members elect, posting them on the points at issue. This has required time, and has been a matter of expense as well. I would recommend that some steps be taken to secure active and competent representation in Washington, should it appear that the movement to pass the Raines amendment becomes dangerous. It is apparent that nothing but constant watchfulness can preserve the law as it stands.

During the past six months much of the routine work of the office has been ably and well performed by Miss J. C. Davis, whose employment the Executive Committee authorized. The work has grown so that I am unable to attend to it all myself, and the assistance has been very welcome.

Respectfully submitted.

WINFIELD SCOTT,  
Secretary.

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## SECOND REPORT.

SAN FRANCISCO, June 12, 1893.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: During the past six months the ordinary business incident to this office has been transacted with the usual promptness. The collection of statistics, the correspondence, the scrap-books, and the distribution of reports have been a source of constant work, in which I have been ably assisted by Miss Davis.

Much of my time has been occupied in carrying out the instructions of the Executive Committee, which have brought about more work than has been the case for some years.

At their suggestion I have prepared a study of the changes in the internal revenue and tariff laws needed by the industry. This has occupied over six weeks, in which time I have received advice not only from the brandy makers and merchants of California, but also from the American Distillers Association, of which I am Advisory Committee from California. I may say here, that the officers of this association desire me to attend a conference on these laws at an early date in Louisville. For various reasons they desire that these laws, all favorable to them and to us, shall emanate from California.

I have made a study of the possibilities of reciprocal trade with France, with results already known to you.

I have prepared copy for a sixty-page pamphlet on California viticulture, for distribution at Chicago.

The work on grape syrup has been received and distributed, as has also the report on the condition of the vineyards in Napa County. The matter for a similar report on the vineyards of Alameda County is ready for publication, and I am informed that the canvass of Sonoma County on similar lines is about finished.

I would suggest that the Board at once prepare a treatise on the handling of bulk wines in small quantities, and on bottling, for distribution among Eastern and other buyers.

Yours,

WINFIELD SCOTT,  
Secretary.

## THIRD REPORT.

SAN FRANCISCO, December 11, 1893.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: Immediately after your last semi-annual meeting in June, at which I was instructed to proceed to Louisville, Cincinnati, and other points, and arrange for united action on certain desired national legislation, I proceeded direct to Louisville on the mission intrusted to me.

Arriving at that city I soon met Mr. J. B. Wathen, the President of the American Distillers and Wholesale Liquor Dealers Association. He at once called two meetings: one of the Directors of the association, and the other of the distillers at large.

The desired measures affecting the internal revenue, prepared by me, were submitted at both of these meetings. After many hours spent in discussion, they were amended in one or two particulars, and approved.

I also visited Owensboro and Cincinnati to ascertain the views of the distillers and distillers' agents clustered at those places, and then deeming my mission closed, returned to California.

As soon as I was back I prepared new drafts of all the laws desired, and a complete study of the tariff as affecting wines. These I prepared for publication in pamphlets by the State Printing Office. The State Board of Examiners, however, would not permit their publication at the State office, holding that the province of the Board did not extend to attending to matters pertaining to legislation. It was in vain that I made two trips to Sacramento to reason with the gentlemen; nor would they permit the studies to be published out of the appropriation of this Board and not out of that of the State Printing Office.

From conversation with private persons in San Francisco who profess to know, it would seem that an attempt is to be made to repeal the Sweet Wine Law. This bill has been reintroduced in Congress exactly in the shape as passed by the last Congress as a portion of the McKinley bill.

I have had an active part in approving the proposed internal revenue tax on wine, and am assured from Washington that the idea is dead.

There is one point on which this Board should take action, and that is in reference to the proposed tariff on brandy and all spirits. The tariff at present, as is well known, is \$2 50 per proof gallon. The Wilson bill proposes to put it at \$1 80 per proof gallon, and at the same time it is considered almost a moral certainty that Congress will raise the internal revenue tax on distilled spirits to either \$1, \$1 10, \$1 25, or even \$1 50 per proof gallon. These two circumstances will place our brandy industry in a most precarious state—far more so than exists at present—and will certainly encourage the importation of beet-spirit brandies from France. It seems to me that active work is needed here at once.

Casting aside matters pertaining to legislation, I will conclude this report by saying that in the past six months my time has been constantly employed, either as above stated or in attending to other duties.

The reports of the census of Alameda County have been compiled and published.



The Sonoma County census has been compiled and published.

The Southern California census has been compiled and is in type at the State Printing Office.

All of the statistics of exports and imports have been carefully kept up, and I can at a moment's notice give any desired statistics for years back, on any point on which such information can possibly be desired.

The correspondence has been maintained as usual.

In all my work I have had the invaluable assistance of Miss Davis.

Respectfully submitted.

WINFIELD SCOTT,  
Secretary.

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#### FOURTH REPORT.

SAN FRANCISCO, June 11, 1894.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: My report at this meeting will not be one of any great extent. During the past six months the routine business of the Board coming through my office has been disposed of as it arose. The scrap-books are being kept up; the statistics of exports of wine and other liquors are maintained; and the business of the office is in good shape.

Good headway is being made in the preparation of the annual report to be given to the State Printer soon. Aside from the regular reports of officers in this report, arrangements have been made with the proper authorities for a description of the Viticultural Palace at the Midwinter Fair, to which this Board contributed largely. Another feature will be a paper by Mr. W. J. Parker, agent of the Mexican Central Railway, on the development of a market for California wines and brandies in the central and eastern portions of Mexico, a field heretofore almost entirely neglected, and yet a most promising one from all accounts. Mr. C. A. Wetmore will contribute a paper on vinification and other topics, and another appendix will be a translation of part of Valery Mayet's "Les Insectes de la Vigne," or at any rate that portion of it relating to phylloxera. This work I have been prosecuting at odd intervals, and it will take me some days of steady work to complete the most essential portions.

Very truly yours,

WINFIELD SCOTT,  
Secretary.

## MINUTES OF THE BOARD.

Minutes of the regular semi-annual meeting of the Board of State Viticultural Commissioners, held at the office, 317 Pine Street, on Monday, December 12, 1892, at 11 o'clock A. M.

Present: President West, Commissioners Bundschu, Shorb, Doyle, Priber, Bichowsky, and De Turk; Chief Executive Officer C. J. Wetmore, and the Secretary. Absent: Commissioners Stephens and Towle.

The minutes of the June meeting were read and approved.

On motion, the reading of the minutes of the Executive Committee was dispensed with.

Commissioner Shorb requested that he be relieved from the Committee on World's Fair. This was granted.

Commissioner Shorb brought up the matter of the expenses incurred in looking after the Anaheim disease. He said that the matter had been a source of constant and considerable expense to him, and that he should be entitled to reasonable recompense as expert when actually engaged. Several Commissioners expressed a similar view. On motion of Commissioner Bundschu, the matter was referred to the Executive Committee with power to act in the premises.

The report\* of E. C. Priber, Commissioner for the Napa District, was presented and ordered to print.

The report\* of C. J. Wetmore, Chief Executive Officer, was read and ordered placed on file. The report evoked considerable discussion on the question of supplying Riparia cuttings to growers. Commissioner Priber stated that the nurserymen as a rule did not like to handle Riparia, on account of the losses. No further action was taken, however.

The report\* of Secretary Scott was read and placed on file.

At the suggestion of Commissioner Shorb the Secretary was instructed to visit the works of the American Concentrated Must Company, at Geyserville, before making his final report.

The following resolutions were unanimously adopted:

*Resolved*, That this Board has heard, with the deepest regret, of the death of Charles Krug, who was a member of the Commission from the date of its organization in 1880 until 1890, and whose services to the State at large, and to the people of the Napa Valley, in the cause of viticulture, were of great and permanent value.

*Resolved*, That the Secretary be directed to express to the family of Mr. Krug the sympathy of the Commissioners, and that as a mark of respect to the memory of the deceased these resolutions be spread upon the minutes of the Board.

The question of the opposition of the Commission to the Raines amendment to the Sweet Wine Law was then brought up. The Commissioners were unanimous in the belief that the Raines bill should be defeated.

Commissioner Shorb suggested that inasmuch as he would depart for the East in about three weeks, he could do some work in Washington

\* These will be found in the regular reports of officers, printed elsewhere.

against the bill, provided arrangements were made for defraying part of his expenses.

On motion, the matter was referred to the Executive Committee, with power to make suitable arrangements with Commissioner Shorb.

A letter was read from Hugh Frazier, a Bordeaux expert, offering his services to any one requiring them. The letter was ordered filed.

Commissioner Shorb brought up the question of attempting to secure reciprocal arrangements with France, as to wines. He submitted a written statement of what, in his judgment, was required. On motion, the matter was referred to the Executive Committee to investigate the matter, and to take such action as is deemed proper.

Recess was then taken until 2 p. m.

On reassembling, the petition of M. M. Baldwin, for appointment as clerk and storekeeper, with letters of recommendations, was presented. Commissioner Shorb stated that he had to leave the meeting, but desired to record his vote for Mr. Baldwin before going. After some discussion, the matter was referred to the Executive Committee for action.

Chas. A. Wetmore offered a letter stating that he had discovered a process of making new wines bottle bright in a short time. This was, on motion of Mr. Bundschu, referred to the Executive Committee.

The treatment of the viticultural industry by the World's Fair Commissioners of California then came up for a long discussion. It was stated that the small space of 26 by 28 feet had been assigned to viticulture in the California Building. Superintendent of Exhibits, W. H. McNeil, was called upon for a statement of facts, and was questioned by Commissioner Priber and others. The action of the World's Fair Commissioners came in for a round of criticism, and then, on motion of Commissioner Priber, a committee of three was appointed to draft a suitable letter to the World's Fair Commission. The Chair appointed Commissioners Priber, Bundschu, and Bichowsky.

Commissioner Priber made a motion that the Viticultural Commissioners authorize the Executive Committee to spend a sum not exceeding \$3,000 in assisting a proper viticultural display. This was seconded and then amended, authorizing the committee to expend any available funds for the purpose. The motion as amended was adopted.

The Commissioners then adjourned.

WINFIELD SCOTT,  
Secretary.

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Minutes of the regular meeting of the Board of State Viticultural Commissioners, held on Monday, June 12, 1893, at 11 A. M., at 317 Pine Street.

Present: President George West, and Commissioners Bundschu, De Turk, Priber, Bichowsky, and Towle, also C. J. Wetmore and the Secretary. Commissioners Doyle, Shorb, and Stephens were absent.

The minutes of the December meeting were read and approved.

The minutes of the meetings of the Executive Committee since December, 1892, were read, and the action of the committee approved.

Commissioner Bundschu presented a report on behalf of the Executive Committee, which was read and placed on file.

Commissioner Bundschu presented a complete report on the condition



of the vineyards of Alameda County, prepared by Frank L. Fowler. The report was read and passed to print.

On motion of Commissioner Bundschu, a vote of thanks was extended to Messrs. F. L. Fowler and William Palmtag for services rendered at Sacramento during the recent Legislature.

Chief Executive Officer Wetmore made a verbal report of his work in Chicago at the World's Fair in setting up the Commission's exhibit, and aiding others, at the same time stating that he would file a written report later.

The report of Secretary Scott was read and placed on file.

On motion of Commissioner Priber, a vote of thanks was unanimously tendered William Forsythe, for his able and successful efforts in behalf of the California wine growers in Chicago.

The matter of printing a pamphlet on viticulture in California for distribution at Chicago was then taken up. On motion, the Chief Executive Officer, the Executive Committee, and the Secretary were instructed to proceed with the work with all possible expedition.

Commissioner De Turk reported that the canvass of Sonoma County for statistics of viticulture was about completed.

Commissioner Bichowsky stated that with the appropriation allowed him—\$400—for the canvass of San Bernardino, Orange, and Los Angeles Counties, he could probably include San Diego County. He was authorized to do so.

Commissioner Priber then moved that when the lease of the present quarters at 317 Pine Street expires, July 1, 1893, the Commission move into other offices. This was unanimously carried.

Recess was then taken to 2 P. M.

During the recess the Commissioners visited the proposed new quarters over the First National Bank, at Bush and Sansome Streets.

On reassembling Commissioner Priber moved that the suite of rooms on the second floor of the First National Bank building, immediately over the bank, be leased for two years from July 1, 1893, at a monthly rental of \$150 per month. Carried.

The equipment of the rooms was, on motion of Commissioner Priber, left to the Executive Committee.

A communication from F. L. Fowler, regarding the proposition of Colonel H. Bendel to combine the producers and thus raise the price of wines, and further suggesting that a thorough personal canvass of the Eastern markets be made, was read and filed.

The Secretary was instructed to inform all viticultural societies and all concerned that the rooms of the Board were open to all who desired to use them for meetings, etc.

Secretary Scott submitted a study of the proposed changes in the internal revenue and customs laws.

On motion of Commissioner Priber, Mr. Scott was instructed to go to Louisville and other distilling centers and confer with the officers of the American Distillers and Wholesale Liquor Dealers Association, and to return if practicable in a month.

The communication of Allen B. Lemmon, asking for the cuts of grape syrup pamphlet, on loan, was referred to Mr. De Turk for action.

Election of officers was then declared in order.

For President, John T. Doyle was nominated by Commissioner De Turk. Mr. West was also nominated, but withdrew. A ballot was

taken, which resulted: John T. Doyle, 4; blank, 1. Mr. Doyle was declared elected.

For Vice-President, Charles Bundschu was nominated. There being no other nominations, the rules were suspended and the Secretary was instructed to cast the unanimous vote of the Commissioners for Mr. Bundschu.

For Treasurer, Allen Towle was nominated. There being no other nominations, the rules were suspended and the Secretary was instructed to cast the unanimous vote of the Commissioners for Mr. Towle.

For Secretary, Winfield Scott was nominated. There being no other nominations, the rules were suspended and Mr. Bundschu was instructed to cast the unanimous vote of the Board for Mr. Scott.

For Chief Executive Officer, Mr. C. J. Wetmore was nominated. There being no other nominations, the rules were suspended and the Secretary was instructed to cast the unanimous vote of the Commissioners for Mr. Wetmore.

Adjourned.

WINFIELD SCOTT,  
Secretary.

President Doyle communicated the following:

To CLARENCE J. WETMORE:

SAN FRANCISCO, June 24, 1893.

DEAR SIR: I shall have to ask you to act as Secretary *pro tem.* of the Commission during Mr. Scott's absence from the State.

I have made the following appointments of committees for the ensuing year, which you will please communicate to the several gentlemen named, without delay.

*Committee on Finance.*—Commissioners Towle, Stephens, and Priber.

*Committee on Vine Pests.*—Commissioners Bundschu, Priber, and West.

*Committee on Distillation.*—Commissioners Priber, Shorb, and Stephens.

*Committee on Table Grapes.*—Commissioners Stephens, Towle, and Bundschu.

*Committee on Experimental Cellars.*—Commissioners Bichowsky, Bundschu, and Shorb.

*Committee on Anaheim Disease.*—Commissioners Shorb and Bichowsky.

*Executive Committee.*—Commissioners West, De Turk, and Bichowsky.

*Auditing Committee.*—Commissioner De Turk.

Yours respectfully,

JOHN T. DOYLE,  
President.

Minutes of the meeting of the Board of State Viticultural Commissioners, held at the office, 101 Sansome Street, on Monday, December 11, 1893, at 11 o'clock A. M.

Present: Commissioners Bundschu, De Turk, West, Bichowsky, and Stephens.

President Doyle being absent, Vice-President Bundschu declined to take the chair, and Mr. West moved that Mr. Priber act as Chairman.

Carried.

The minutes of the last meeting (June, 1893) were read and approved.

The minutes of the meetings of the Executive Committee since June were read and approved.

Reports of officers were called for.

The report of C. J. Wetmore, Chief Executive Officer, was read and filed.

The report of Secretary Scott was read and filed.

The report of Chas. A. Wetmore, who went to Chicago on a special mission, was read and filed.

The open letter of Charles E. Bowen, in reference to the sale of wines at the Midwinter Fair grounds, was read. After some discussion the letter was, on motion, referred to the meeting of wine men, to be held this afternoon.

On motion of Mr. Stephens, a committee of two was authorized to call on the Midwinter Fair authorities with reference to securing some means for the sampling of all wines on the grounds.

The Chair appointed Messrs. Bundschu and De Turk.

Mr. Bundschu offered the following resolution, which was unanimously adopted:

*Resolved*, That it is the sense of the Board of State Viticultural Commissioners that the Executive Committee of the Midwinter Fair be urged to use special efforts to secure an impartial and intelligent representation of California wines at the Midwinter Fair in all such places where concessions have been, or will be, granted to sell such wines to visitors; and that no discrimination to the detriment of our products shall take place.

Carried.

The matter of the proposed reduction in the duties on brandy and raisins was brought up. After considerable discussion, the Secretary and Chief Executive Officer were instructed to draw up a protest against such reductions and to report at the afternoon session.

The Secretary was granted a leave of absence of about two weeks, beginning December 27th.

Recess was then taken until 2 P. M.

On reassembling, the Secretary and Chief Executive Officer were not yet ready to report in the matter of the protest against reduction of duties, and the question was left to these officers for action immediately.

Mr. J. J. Jacobi appeared before the Board in reference to the reduction of duties, and also in regard to the internal revenue tax on wine, which was threatened.

On motion, the matter was also referred to the Chief Executive Officer and Secretary, to draw up resolutions to the Pacific Coast delegation, warning them against the proposed tax.

Adjourned.

#### ACTION OF THE BOARD.

WHEREAS, It is proposed by the Committee on Ways and Means of the House of Representatives of the United States to reduce the import tariff on raisins from 2½ cents to 1½ cents per pound; and whereas, such action would cause the uprooting of many thousands of acres of raisin grapes in various portions of this State, and would cause the resultant financial ruin of a large proportion of people who have embarked their possessions in this branch of viticultural industry; be it

*Resolved*, By the Board of State Viticultural Commissioners of California, acting on behalf of the raisin growers and packers, That we protest in unmeasured terms against such proposed action, considering that at the present time and under equitable tariff conditions, it is in none too flourishing a state, and needs fostering rather than discouragement.

*Resolved*, That these resolutions be sent to the Pacific Coast delegation in Congress and to the press.

WHEREAS, It is reported that the Ways and Means Committee of the House of Representatives of the United States will recommend that the tariff on brandy and distilled spirits imported into the United States be reduced from the present rate of \$2 50 per proof gallon to \$1 80 per proof gallon; be it

*Resolved*, That the Board of State Viticultural Commissioners, as representatives of the viticultural interests of California, protests most strenuously against such reduction; that any lessening will stimulate the importation of foreign compounded brandies in which beet and potato spirits enter largely, to the detriment of the health of the peo-



ple; that the reduction will not in any manner stimulate the importation of the better grade of goods.

*Resolved*, That if, as is now threatened, the internal revenue tax on brandy and all distilled spirits is raised from 90 cents per proof gallon, the margin between the domestic tax and the import tariff will be so small as to discourage domestic producers, and will inevitably result in decreased domestic production.

*Resolved*, That these resolutions be sent to the Pacific Coast delegation in Congress and to the press.

WINFIELD SCOTT,  
Secretary.

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SAN FRANCISCO, June 11, 1894.

A meeting of the Board of State Viticultural Commissioners was held this day at 11 A. M. at 101 Sansome Street.

Present: President Doyle, and Commissioners De Turk, West, Crabb, and Towle, also Chief Executive Officer Wetmore and the Secretary.

The minutes of the December, 1893, meeting were read, amended, and approved.

The minutes of the meetings of the Executive Committee since the December meeting were read.

The report of C. J. Wetmore, Chief Executive Officer, was read, and, on motion, was placed on file.

The report of Commissioner H. W. Crabb, of the Napa District, was read and placed on file.

The report of Secretary Scott was read and placed on file.

Letters were read from A. H. Brown, of Riverside, who had been arrested and fined in Riverside County for selling wine from his winery. The Secretary was, after some discussion, instructed to write to Mr. Brown for a copy of the record in his case.

Mr. Wetmore made a report on the plan now being formulated to secure better prices for grapes and wines by the formation of a syndicate. After a long discussion the following resolutions, offered by Mr. West, were adopted:

*Resolved*, That the proposal of the committee of wine growers, now communicated by Mr. C. J. Wetmore, if carried out, is, in our opinion, well calculated to obtain the object proposed; and if successful will be of the highest benefit to the viticultural interests of the State.

*Resolved*, That the Chief Viticultural Officer be directed to devote himself at once to the carrying out of this project, and for that purpose to call meetings in the various viticultural districts or counties, which he will attend in person or by deputy appointed by him, and urge the scheme upon the wine growers generally; and that he be authorized to print a sufficient number of blank contract forms, after approval as to their form by the President of this Commission and by the Chairman of the Executive Committee, who are authorized to take professional advice on the subject.

*Resolved*, That \$500, payable out of the appropriation for the forty-sixth fiscal year, be appropriated for the expenses of the work, to be accounted for by the Chief Executive Officer.

Election of officers was then declared in order, and ballots for President were taken.

For President, John T. Doyle received four votes, and one was blank. Mr. Doyle was declared elected.

For Vice-President, E. C. Bichowsky received four votes, and Charles Bundschu one vote. Mr. Bichowsky was declared elected.

For Treasurer, H. W. Crabb received four votes, and one vote was blank. Mr. Crabb was declared elected.

For Secretary, Winfield Scott received five votes, and was declared elected.

For Chief Executive Officer, C. J. Wetmore received five votes, and was declared elected.

The death of R. B. Blowers, a member of the first Board, was announced. Mr. West was appointed to draft resolutions, and submitted the following, which were adopted:

*Resolved*, That this Board has heard, with the utmost regret, of the death of R. B. Blowers, who was identified with the Commission from its inception, in 1880, and who has contributed greatly to the development of viticulture and of raisin making in the State.

*Resolved*, That we tender the family of the deceased our condolence, and that this resolution be spread upon the minutes.

After an informal discussion of the café project for the Eastern cities, the Board adjourned.

WINFIELD SCOTT,  
Secretary.

## NEW SWEET WINE LAW.

At the request of numerous sweet wine makers, the Sweet Wine Law, as amended by the recently passed tariff and revenue law, is given herewith :

## SWEET WINE LAW.

SECTION 42. That any producer of sweet wine, who is also a distiller, authorized to separate from fermented grape juice, under Internal Revenue laws, wine spirits, may use, free of tax, in the preparation of such sweet wines, under such regulations and after the filing of such notices and bonds, together with the keeping of such records and the rendition of such reports as to materials and products, as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, may prescribe, so much of such wine spirits so separated by him as may be necessary for the preservation of the saccharine matter contained therein ; *provided*, that the wine spirits so used free of tax shall not be in excess of the amount required to introduce into such sweet wines an alcoholic strength equal to fourteen per centum of the volume of such wines after such use ; *provided further*, that such wine containing, after such fortification, more than twenty-four per centum of alcohol, as defined by section three thousand two hundred and forty-nine of the Revised Statutes, shall be forfeited to the United States ; *provided further*, that such use of wine spirits free from tax shall be confined to the months of August, September, October, November, December, January, February, March, and April of each year. The Commissioner of Internal Revenue, in determining the liability of any distiller of fermented grape juice to assessment under section three thousand three hundred and nine of the Revised Statutes, is authorized to allow such distiller credit in his computation for the wine spirits used by him in preparing sweet wine under the provisions of this section.

SEC. 43. [As amended by the new tariff and revenue bill of 1894.] That section forty-three of the Act approved October first, eighteen hundred and ninety, entitled "An Act to reduce the revenue and equalize duties on imports and for other purposes," be amended so as to read as follows: "*That the wine spirits mentioned in section forty-two of this Act is the product resulting from the distillation of fermented grape juice, and shall be held to include the product commonly known as grape brandy; and the pure sweet wine which may be fortified free of tax, as provided in said section, is fermented grape juice only, and shall contain no other substance, of any kind whatever, introduced before, at the time of, or after fermentation, and such sweet wine shall not contain less than four per centum of saccharine matter, which saccharine strength may be determined by testing with Balling's saccharometer, or must scale, such sweet wine, after the evaporation of the spirit contained therein, and restoring the sample tested to original volume by addition of water; provided, that the addition of pure boiled or condensed grape must, or pure crystallized cane or beet sugar,*



*to the pure grape juice aforesaid, or the fermented product of such grape juice prior to the fortification provided for by this Act, for the sole purpose of perfecting sweet wines according to commercial standard, shall not be excluded by the definition of pure sweet wine aforesaid; provided further, that the cane or beet sugar so used shall not be in excess of ten per centum of the weight of the wines to be fortified under this Act."*

SEC. 43. [In its original form.] That the wine spirits mentioned in section forty-two of this Act is the product resulting from the distillation of fermented grape juice, and shall be held to include the product commonly known as grape brandy; and the pure sweet wine which may be fortified free of tax as provided in said section, is fermented grape juice only, and shall contain no other substance of any kind whatever introduced before, at the time of, or after fermentation, and such sweet wine shall contain not less than four per centum of saccharine matter, which saccharine strength may be determined by testing with Balling's saccharometer, or must scale, such sweet wine after the evaporation of the spirits contained therein, and restoring the sample tested to original volume by addition of water.

SEC. 44. That any person who shall use wine spirits as defined by section forty-three of this Act, or other spirits on which the Internal Revenue tax has not been paid, otherwise than within the limitations set forth in section forty-three of this Act, and in accordance with the regulations made pursuant to this Act, shall be liable to a penalty of double the amount of the tax on the wine spirits or other spirits so unlawfully used. Whenever it is impracticable in any case to ascertain the quantity of wine spirits or other spirits that have been used in violation of this Act in mixtures with any wines, all alcohol contained in such unlawful mixtures of wine with wine spirits or other spirits in excess of ten per centum shall be held to be unlawfully used; *provided, however*, that if water has been added to such unlawful mixtures either before, at the time of, or after such unlawful use of wine spirits or other spirits, all the alcohol contained therein shall be considered to have been unlawfully used. In reference to alcoholic strength of wines and mixtures of wines with spirits in this Act, the measurement is intended to be according to volume and not according to weight.

SEC. 45. That under such regulations and official supervision, and upon the execution of such entries and the giving of such bonds, bills of lading, and other security as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe, any producer of pure sweet wine, as defined by this Act, may withdraw wine spirits from any special bonded warehouse free of tax, in original packages, in any quantity not less than eighty wine gallons, and may use so much of the same as may be required by him, under such regulations, and after the filing of such notices and bonds, and the keeping of such records, and the rendition of such reports as to the materials and products and the disposition of the same, as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe, in fortifying the sweet wine made by him, and for no other purpose, in accordance with the limitations and provisions as to uses, amount to be used, and the period for using the same, set forth in section forty-two of this Act; and the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, is authorized, whenever he shall deem it necessary for the prevention of violations of this law, to prescribe that wine spirits withdrawn under this section shall not be used to fortify wines except at a certain distance, prescribed by him, from the distillery, rectifying-house, winery, or other establishment used for pro-

ducing or storing distilled spirits, or for making or storing wines other than wines which are so fortified, and that in the building in which such fortification of wines is practiced no wines or spirits other than those permitted by his regulation shall be stored. The use of wine spirits free of tax for the fortification of sweet wines under this Act shall be begun and completed at the vineyard of the wine grower where the grapes are crushed and the grape juice is expressed and fermented, such use to be under the immediate supervision of an officer of Internal Revenue, who shall make returns describing the kinds and qualities of wine so fortified, and shall affix such stamps and seals to the packages containing such wines as may be prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury; and the Commissioner of Internal Revenue shall provide by regulations the time within which wines so fortified with the wine spirits so withdrawn may be subject to inspection, and for accounting for the use of such wine spirits, and for re-warehousing, or for payment of the tax on any portion of such wine spirits which remain not used in fortifying pure sweet wines.

SEC. 46. That wine spirits may be withdrawn from special bonded warehouses at the instance of any person desiring to use the same to fortify any wines in accordance with commercial demands of foreign markets, when such wines are intended for exportation, without the payment of tax on the amount of wine spirits used in such fortification, under such regulations, and after making such entries, and executing and filing, with the Collector in the district from which the removal is to be made, such bonds and bills of lading, and giving such other additional security to prevent the use of such wine spirits free of tax otherwise than in the fortification of wine intended for exportation and for the due exportation of the wines so fortified, as may be prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury; and all of the provisions of law governing the exportation of distilled spirits free of tax, so far as applicable, shall apply to the withdrawal and use of wine spirits and the exportation of the same in accordance with this section; and the Commissioner of Internal Revenue is authorized, subject to the approval of the Secretary of the Treasury, to prescribe that spirits intended for the fortification of wines under this section shall not be introduced into such wines except under the immediate supervision of an officer of Internal Revenue, who shall make returns describing the kinds and quantities of wines so fortified, and shall affix such stamps and seals to the packages containing such wines as may be prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury. Whenever such wine spirits are withdrawn, as provided herein, for the fortification of wines intended for exportation by sea, they shall be introduced into such wines only after removal from storage and arrival alongside of the vessel which is to transport the same; and whenever transportation of such wines is to be effected by land carriage, the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, shall prescribe such regulations as to sealing packages and vehicles containing the same, and as to the supervision of transportation from the point of departure, which point shall be determined as the place from which such wine spirits may be introduced into such wines, to the point of destination, as may be necessary to insure the due exportation of such fortified wines.

SEC. 47. That all provisions of law relating to the reimportation of any goods of domestic growth or manufacture which were originally liable to an Internal Revenue tax, shall be, as far as applicable, enforced against any domestic wines sought to be reimported, and duty shall be levied and collected upon the same when reimported, as an original importation.

SEC. 48. That any person using wine spirits or other spirits which have not been tax paid, in fortifying wine otherwise than as provided for in this Act, shall be guilty of a misdemeanor, and shall, on conviction thereof, be punished for each offense by a fine of not more than two thousand dollars, and for every offense other than the first, also by imprisonment for not more than one year.

SEC. 49. That wine spirits used in fortifying wines may be recovered from such wine only on the premises of a duly authorized grape brandy distiller, and for the purpose of such recovery, wine so fortified may be received as material on the premises of such a distiller, on a special permit of the Collector of Internal Revenue in whose district the distillery is located; and the distiller will be held to pay the tax on a product from such wines as will include both the alcoholic strength therein by the fermentation of the grape juice and that obtained from the added distilled spirits.



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# APPENDICES.

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[APPENDICES A AND B ARE BOUND SEPARATELY.]

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PLATE I.—EXTERIOR OF VITICULTURAL PALACE.

[Published by permission of Taber, photographer, San Francisco.]

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## APPENDIX C.

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# THE MIDWINTER FAIR DISPLAY.

[With five illustrations. Published by permission of Taber, photographer,  
San Francisco.]

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PLATE I.—EXTERIOR VIEW OF THE VITICULTURAL PALACE.

PLATE II.—LOWER PORTION OF THE CENTER PIECE.

PLATE III.—STATUARY CAPPING THE CENTER PIECE.

PLATE IV.—VIEW OF ONE SIDE OF THE DISPLAY.

PLATE V.—VIEW IN THE WEINSTÜBE.

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# MIDWINTER FAIR DISPLAY.

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## THE COMMISSION'S WORK.

The State Board of Examiners, having consented to the expenditure of a portion of the appropriation of the Board of State Viticultural Commissioners toward making an elaborate and harmonious display of vineyard products at the Midwinter International Exposition, held at San Francisco in the first half of the year 1894, it is but right and proper that a full report of the proceedings in that connection be embodied in this report of the Board.

By vote of the exhibitors, the members of the Board were made members of the Executive Committee of Viticultural Exhibitors. One of the members of the Board, Commissioner I. De Turk, was Chairman of this Committee; another, Commissioner Charles Bundschu, was Chairman of the Building Committee, and on his shoulders fell much of the work in hand. The Secretary of the Board was also Secretary of the Exhibitors, and the Chief Executive Officer, as well as the other Commissioners, not only gave their time to the work in hand, but contributed largely out of their private funds to the work. The office of the Viticultural Exhibitors was permanently located in the office of the Board, at 101 Sansome Street, San Francisco, and all meetings were held there.

The Executive Committee of the Exhibitors was made up as follows:

I. De Turk, *President*.  
Clarence J. Wetmore, *Vice-President*.  
Winfield Scott, *Secretary*.  
Charles Bundschu, *Treasurer*.  
Tiburcio Parrott.  
William Wehner.  
F. Korbcl.

Hans H. Kohler.  
H. W. Crabb.  
Allen Towle.  
George West.  
P. C. Rossi.  
A. Repsold.  
E. C. Priber.

John T. Doyle.  
J. DeBarth Shorb.  
C. Carpy.  
Henry Epstein.  
F. Beringer.  
E. C. Bichowsky.  
R. D. Stephens.

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## THE BUILDING.

The building, usually designated as the "Viticultural Palace," was a splendid structure of staff, surmounted by a circular dome. In size it was 50 by 75 feet, and was located immediately to the west of the north wing of the Main Horticultural Building, with which it was connected by a stairway. The principal entrance opened to the north and led to the pathways to the Southern California Building and the Santa Barbara pyramid.

The main entrance was through the end of a great wine oval, and once within, the visitor was ushered into what was without doubt the most harmonious and effective exhibit of wines and brandies ever made in California or in any other Exposition. The principal exhibition room was about 50 by 50 feet in size, and here the products of some fifty-two wine makers and merchants were displayed. Mr. H. M. La

Rue, who was Chief of Viticulture at Chicago, was loud in his regrets that California did not make such a comprehensive show at the great World's Fair.

In the center was a great piece in the shape of a ten-sided polygon, surmounted by plaster casts of Bacchus and Mercury, seated on a globe of plaster. In the center of the polygon was an office, in which Mr. J. R. Baker made his headquarters, while surrounding the whole were booths in which the members of the San Francisco Wine Dealers' Association had their displays.

Reference to the plan of exhibits will show the location of different county exhibits grouped together. These were unusually tasty and were arranged in alcoves.

Within the Weinstübe, which was located just south of the main exposition room, were numerous tables and chairs devoted to the use of those who desired to taste wines. At the west end of the Weinstübe were placed two great oak casks. One of these bore the inscription:

"What is it to us if taxes rise or fall?  
Thanks to our Fortunes, we soon pay none at all."—*Churchill*.

WINE GROWERS OF CALIFORNIA.

Sunbeams condensed from Nature's holy shrine  
Are gently housed in every drop of wine.

Back of these casks was a painting showing in perspective the interior of a wine cellar.

On the east side of the Weinstübe was a painting of San Francisco and vicinity, furnished by the San Francisco Wine Dealers' Association. The south side of the Weinstübe was lighted by stained-glass windows.

The decorations of the entire Viticultural Palace were of staff, and all the pillars and rafters were covered with vines and bunches of grapes.

Among the chief features of the decorations were the verses and mottoes which were painted on the interior, all being well selected and to the point. These inscriptions were found both in the main exhibition room and in the Weinstübe. Those in the main room were as follows:

Welcome the coming guest—  
The wine will do the rest.

Wer nicht liebt Wein, Weib und Gesang,  
Der bleibt ein Narr sein Leben lang.

Champagne! Le Vin des Roi, le Roi des Vins.

Good wine maketh good blood;  
Good blood maketh good thoughts;  
Good thoughts bring forth good works;  
Good works carry a man to heaven.

Ergo,

Good wine carrieth a man to heaven.

Wine that maketh glad the heart of man.

Viva Baccho che cent anni  
Ca compare senz affani.

Drink to-day and drown all sorrow;  
You may not do it to-morrow.

Hail! Bacchus, Hail!  
Thy reign can never fail!

Good wine is a good familiar  
Creature, if it be well used.

El Vino que es bueno  
No ha menester pregonero.

Ne continue pas a ne boire que de l'eau; mais use d'un peu de vin, a cause de ton estomac et de tes frequentes indispositions.

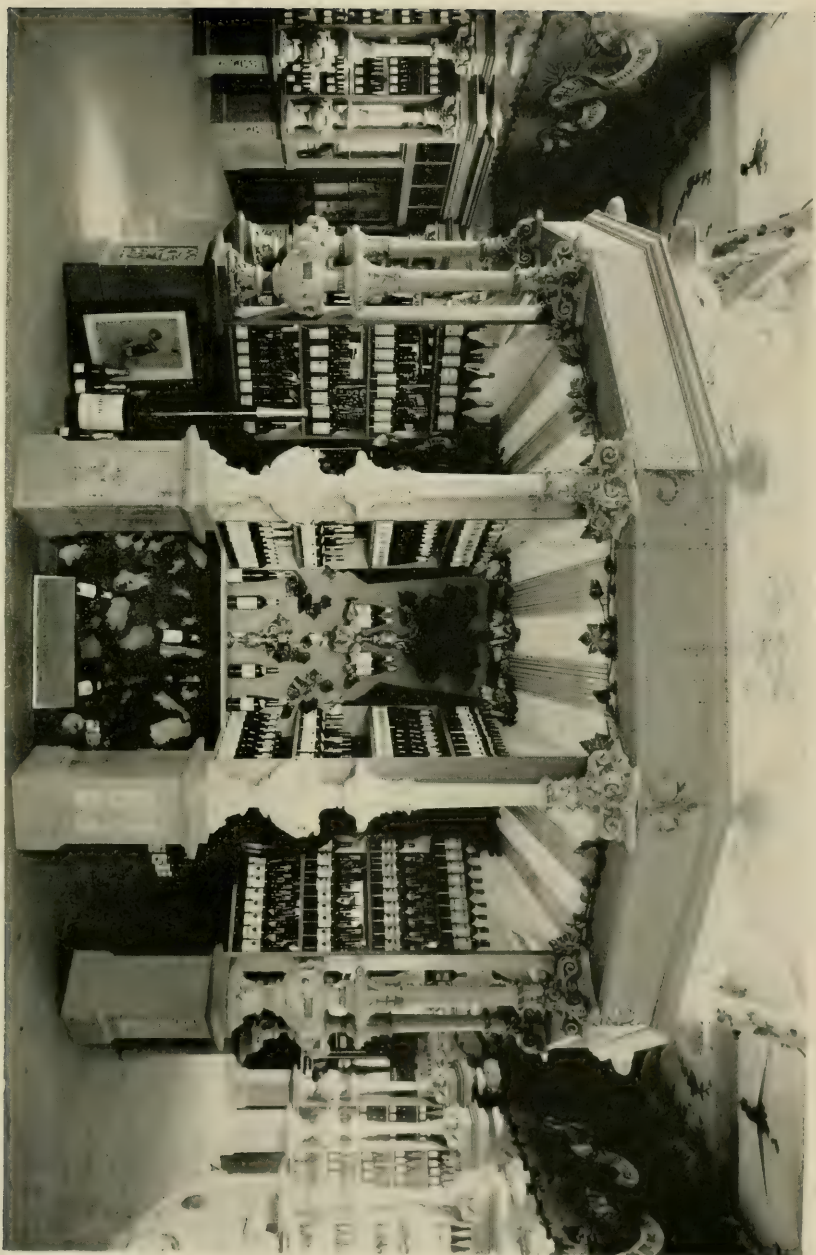


PLATE II.—[LOWER PORTION OF CENTER PIECE.]





Those in the Weinstübe were as follows:

Good company,  
Good wine,  
Good welcome,  
Can make good people.

Die Weise guter Zecher ist,  
In frueh und späeter Stunde;  
Das alter Wein ein Becher ist,  
Und neuer Witz im munde.

Viva quest' attanio divin liquor  
Che lieto m'erceta estra d'amor.

Hail, California, glory to thee!  
Nature's great wonder, noble and free.

Let us have wine, mirth, and laughter,  
Sermons and soda water the day after.

To be, or not to be; that is the question—  
Sit down, my friend, and drink; it helps digestion.

A general welcome from His grace.  
Old Bacchus salutes ye all!

Some hae wine that canna drink,  
And some would drink that want it;  
But we hae wine and we can drink,  
Sae let the Laird be thankit.—*After Burns.*

Blest be that spot where cheerful guests assemble.

Wine makes Love forget its cares.

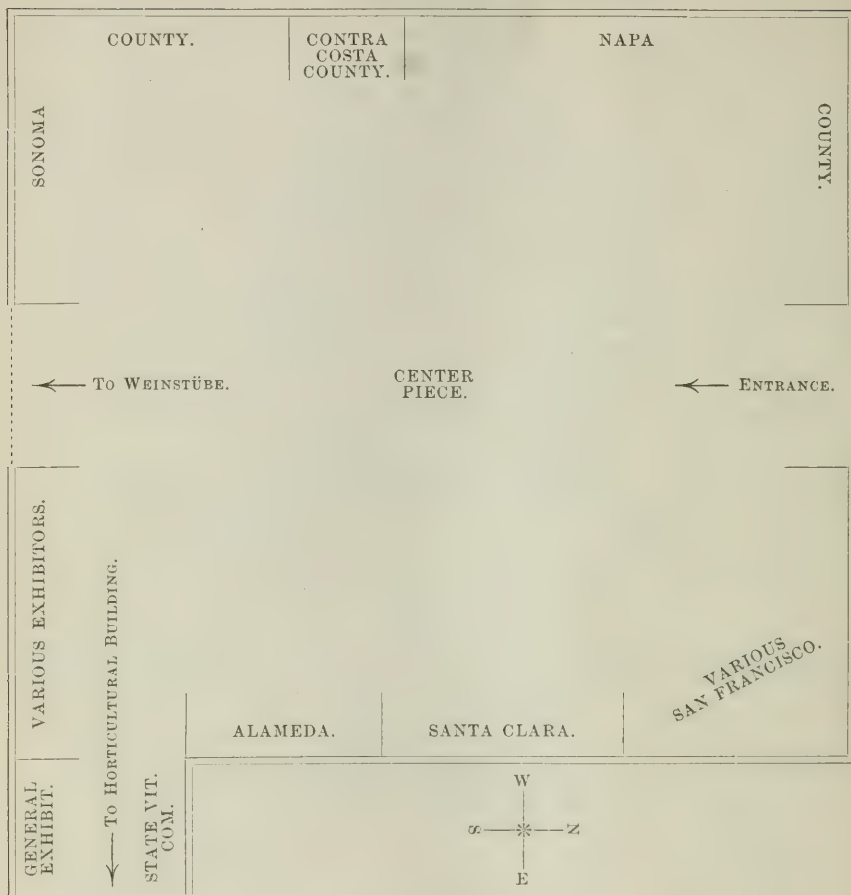
Too much you may touch;  
But never enough—  
If good be the stuff!

Why, 'tis as it should be! Here, amidst bright eyes and faces; here, sorrow cannot reach.

El Vino dice la verdad  
Por que no trae bragas,  
Ni dépano, ni de lino.

Au matin bois le vin blanc,  
Le rouge au soir pour le sang,  
Mais au milieu du jour,  
Buvez toujours.

## PLAN OF VITICULTURAL PALACE.



## CENTER PIECE.

Napa Valley Wine Company.  
J. Gundlach & Co.  
C. Schilling & Co.  
Arpad Haraszthy & Co.  
B. Dreyfus & Co.  
Kohler & Frohling.  
Kohler & Van Bergen.  
Lachman & Jacobi.  
S. Lachman Company.  
C. Carpy & Co.

## VARIOUS, SAN FRANCISCO.

A. Repsold & Co.  
Lenormand Bros.  
Cal. Wine Growers' Union.  
Justinian Calre.  
Sanders' Stills.  
Woodin & Little.  
Abramson-Heunisch Co.

## SONOMA COUNTY.

F. Korbel & Bro.  
Italian-Swiss Colony.  
I. De Turk.  
Fulton Winery Company.  
Dresel & Co.  
Sebastopol Winery Company.  
J. Chauvet.  
Fountaingrove Vineyard Co.

B. W. Paxton.  
J. O'B. Gunn.  
E. Schirmer.

## NAPA COUNTY.

M. M. Estee.  
Martin Sachs.  
J. A. Stanly.  
Geo. Schoenwald.  
Edge Hill Vineyard Company.  
Jacob Schram.  
Beringer Bros.  
Inglenook Vineyard.  
Otto Normann.  
Tiburcio Parrott.  
Ewer & Atkinson.  
Kortum & Fuelscher.  
Henry Hagen.  
A. Grimm & Co.  
A. Brun & Co.  
G. F. Chevalier.  
H. W. Crabb.

## SANTA CLARA COUNTY.

William Wehner.  
Los Gatos and Saratoga Wine Co.  
Paul Masson.  
E. E. Goodrich.  
C. A. Baldwin.  
J. C. Merithew.  
Los Gatos Cooperative Winery.

Saratoga Wine Company.  
A. R. Scott.

## ALAMEDA COUNTY.

J. L. Beard.  
J. W. Stanford.  
Chauche & Bon.  
C. A. Wetmore.  
H. B. Wagoner.  
Jno. Crellin & Sons.

## CONTRA COSTA COUNTY.

B. H. Upham.  
Mt. Diablo Wine Company.  
Jos. Naphthaly.

## VARIOUS EXHIBITORS.

Ben Lomond Wine Co., Santa Cruz.  
Wm. Palmtag, Hollister.  
H. R. Schell, Knight's Ferry.  
Natoma Vineyard Company, Natoma.  
Geo. West & Son, Stockton.  
Eggers' Vineyard Company, Fresno.  
Fresno Vineyard Company, Fresno.



## CEREMONIES AT THE OPENING.

Amid great applause and the clinking of glasses, the Viticultural Palace at the Midwinter Fair was formally opened on April 7th, and while the crowd present was not large, it was thoroughly representative. The guests of the occasion were seated at tables with glasses of sparkling wine before them, and with other refreshments close at hand.

Mr. Chas. Bundschu, as Chairman of the Building Committee, was the first speaker. He said:

*Ladies and Gentlemen:* The duty devolves upon me, and I accept the same with a feeling of joyful gratification, to present to the Executive Committee of Viticultural Exhibitors this new addition to our glorious Midwinter Fair—this Palace of Viticulture. After extended labors it stands completed in its artistic glory and its wonderful harmony of beauty. In the name of the Building Committee, I hereby tender it to you, Mr. President, and to your exhibitors, and trust it may proclaim the proud position we so justly claim for our industry in spite of all reverses. May it mark the beginning of a new era, and may the dawn of prosperity and better times for our vineyardists radiate from its picturesque dome.

The available funds, \$2,076 from the State Viticultural Commission, \$3,182 50 from subscriptions by vineyardists and others, \$3,500 from the San Francisco Wine Dealers' Association, in all, \$8,758 50, were hardly sufficient to undertake, finish successfully, and pay for a work of these dimensions. But the members of your Building Committee—Messrs. Henry Epstein, E. C. Priber, Wm. Wehner, Clarence Wetmore, Tiburcio Parrott, F. Korbel, Claus Schilling, and my humble self as Chairman—worked faithfully to bring about a satisfactory result. Assisted by our architect, Mr. J. I. Newsom, and by the liberal contractor of the building, Mr. T. M. McLachlan, but above all ably supported by the untiring energy of our artistic decorator, Mr. Ernst A. Otto, seconded by the genial sculptor, Mr. Dobbertin, we accomplished our trust. I may also mention here the unremitting assistance tendered to us by Mr. J. R. Baker, our Manager. To all these gentlemen the committee expresses sincerest thanks and appreciation. Our task has been fulfilled, and we hereby surrender the building to its noble purposes.

Mr. I. De Turk, the Chairman of the Executive Committee of the Viticultural Exhibitors, accepted the structure from the Building Committee. He said:

It affords me great pleasure, on the part of the Executive Committee of the Viticultural Exhibitors, to take from the Building Committee this beautiful structure, which is such a credit to viticulturists, and at the same time such a credit to the Exposition. I trust that this will not only mark a new era in viticulture in California, but that it will mark a season of such harmony as we have not recently experienced. I take great pleasure in now turning the building over to the Executive Committee of the Midwinter Exposition, for whom I believe Director-General de Young will speak on this occasion.

Director-General M. H. de Young was greeted with applause when he arose to speak. He said:

*Mr. President, Ladies and Gentlemen:* It becomes part of my official duty to be present at and to say something generally at the opening of the different sections of this Exposition, but as I look around me here to-day, I think I echo your sentiments when I say that I do not believe you want to listen to a speech. Yet I cannot escape a feeling of pride, which I am sure you must share, in what we see here to-day; pride in our viticulturists, who have had the energy and the power to make such a beautiful viticultural display in the face of the depression which has existed in that line of business. I look upon viticulture as the principal, or one of the principal, interests of our State. In all my public acts I have uniformly been a friend of viticulture and the viticulturists. I have a strong belief in the future and lasting success of our State in the development of this great industry. The American people, I am proud to say, are fast becoming educated to the fact that good wines can be produced in our own country. A few years ago one could not get a glass of California wine at an American hotel or restaurant, but now it is being placed on bills of fare, and is fast becoming popular. This is a small matter, perhaps, but it shows the advancement that California wines are making.

The Wilson bill, which was passed the other day in Washington, left a tariff of 50 cents a gallon on wine, and by some jugglery an amendment was added in the House by which no duty shall exceed 100 per cent ad valorem. Now what does this mean? It means that cheap wine, which is brought to this country in wood, and which is billed at 8 cents a gallon, shall not be charged more than 8 cents duty, so that it can be sold as

low as 16 cents. I simply call your attention to this fact, because it seriously threatens your interests; unless some of your representatives in Washington stop it, grave results may follow.

And now, Mr. President, I do not want to take up your time, as I understand there are other speakers to be heard, but, in the name of the Executive Committee of the Exposition, I thank you for this beautiful building, for the interest you have taken in making this display, and for the loyalty you have already shown the Exposition and the support you have given it.

At the conclusion of Mr. de Young's speech, Mr. F. A. Haber, Chief of the Bureau of Viticulture, was called upon for a few remarks. He spoke as follows:

*Ladies and Gentlemen, and Viticulturists:* I agree fully with the Chairman of the Building Committee that this auspicious opening of this beautiful palace ought to bring a new era, not only in the viticultural industry, but a new era in connection with all industries in California. Following closely, as it does, the opening of this Exposition, the third largest in the world, and second to none in its artistic surroundings, it should indeed mark the beginning of a new era. But the opening of this palace means more than the beginning of a new era in a business sense. What we have been suffering from, particularly in connection with viticulture in this State, is not so much a low price for our wines as it is from a lack of information regarding them. There has been a lack of knowledge of what wine is, and what it ought to be, in every country. If we could induce Americans to drink their own wines, it would answer two of the most important questions before our country to-day. Perhaps the greatest question at issue, from a moral sense, is temperance or intemperance. Wine is temperance. We have but to look to the wine-producing countries of the world: to France, to Spain, to Italy, to Germany, and to the south of Russia, and we find there that drunkenness is the exception, and it is because the people there drink wine.

When the American people shall become a wine-drinking people, they will be a temperate people. You will readily recognize the fact that Americans are not wine-drinkers when I tell you that the one city of Paris consumes about three times more wine than the whole of the United States of North America. Paris last year consumed 110,000,000 gallons of wine, and the entire amount consumed in this country last year was 44,000,000 gallons. If we become wine drinkers, we will not have need of prohibition laws, and we will close the mouths of the carpers who are trying to undermine the very ground-work of our National Constitution. When Americans learn to drink their own wines, eat their own food, and wear their own manufactures, they will have no need of tariff laws. These are certainly important considerations.

You wine merchants know that what I say is true, and many of you have lived to see great changes in this connection. I, myself, am not a very old man; indeed, I consider myself a very young man; but I remember that in the city of New Orleans, where I was raised, there was on a certain block one lager beer saloon, and every man who went into that saloon was pointed out as a beer-drinker. What is the history of beer in this country? We are the third largest beer-drinking population in the world, and it has been simply a lack of education that has not made us wine-drinkers instead. We have first to thank the German-Americans for opening the way to the people of this country out of the fanaticism that so long possessed it, and I am glad to know and to feel that there is hope for the further development of the American people in the direction of making a greater use of their own products in this line.

I propose a name dear to every wine grower and dealer in the United States—a woman who has done more than any other for the cause of temperance and breaking down the barriers of ignorance in regard to our great interest, who has devoted her time and the columns of her journal, "Kate Field's Washington," in preaching the gospel of the grape. No one deserves more thanks, and we here evince our deep appreciation of her great services in saying: "All honor to Kate Field."

The last speaker of the occasion was Hon. M. M. Estee, who was introduced by Chairman Bundschu, and who spoke as follows:

*Ladies and Gentlemen:* I was invited out here by the producers of California to talk to you a few minutes to-day; but I think, judging from the surroundings, that few of you came here to listen to speeches. I think it would be a travesty on the occasion for me to attempt even a little speech, and that is certainly the only sort of one I could make under the circumstances, for I have not been here long enough yet to feel the effects of your wine. However, if I were to say anything to you here to-day, I would say that grape growing in California is one of the most important industries of the State. I would say that God made this a grape-growing country, and man cannot change it. It is true that we may have to change our tariff laws; but the grape will grow in California just the same, and we must provide a market for it. Times may come when the merchants, and the producers as well, may find themselves in debt. Most of us are in debt; at least all are in my section of the country; and yet the culture of the grape goes on, because the soil, the climate, and everything about California makes it the

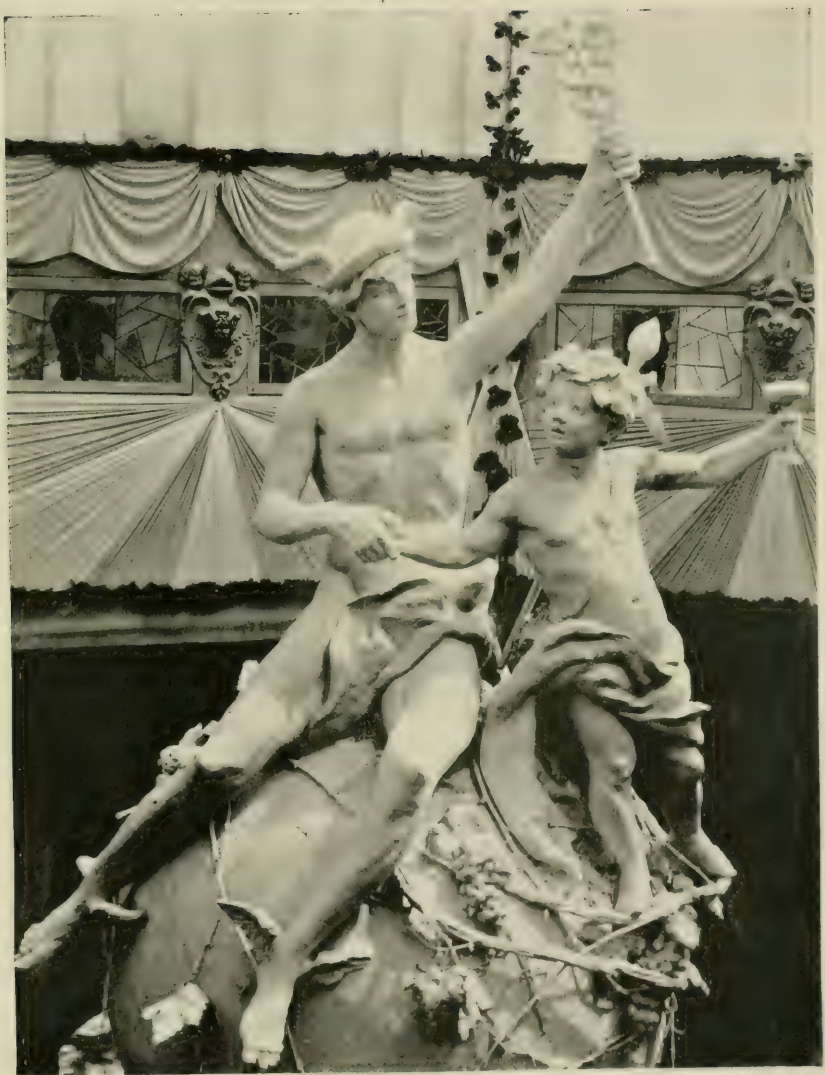


PLATE III.—STATUARY CAPPING THE CENTER PIECE.

[Published by permission of Taber, photographer, San Francisco.]





home of the grape. No country in the world presents such advantages for viticulture and viniculture as California, and if we fail it will be through our own mistakes. It will be because we, as Californians, do not know how to carry on the business. We have from sixty to seventy millions of dollars invested in California in viticulture, and we have 80,000 acres of land in wine grapes, and 100,000 acres in table grapes and raisin grapes. We have 700 wine cellars in this State, and, ordinarily, we ought to make about 25,000,000 gallons of wine. Of course that is more than we can drink. We may be very bad, or good, but we cannot drink that much wine, and so we have to sell some of it.

Recently we tried to sell it, and some have failed; but that should not discourage us. We are satisfied that we are improving the industry. We are making better wine than we ever made. We are making first-class wines. We are making as good wine as is made in any country of the civilized world. We make a very good champagne, though brother Haraszthy over there may not think so, and we make as good a white wine as any of the white wines of the Old World, except the very finest grades. There's a place called "Hedgeside" where I think we make good claret. We are not discouraged; we are encouraged. If we cannot sell our wines, we have to keep them. They say that wines are better as they grow old. If that be so, then, my friends, come around in a year or two from now and you will find us with generous hearts and with even better wines in our cellars. If there are any Eastern people here, I hope they will visit us at our homes among the vines, and when we open our doors to them we will say, "Look here and be satisfied. Come to this land of silver and honey and wine and fruit and be happy. If you have some money bring it with you. Don't leave that behind, because we need it." I trust that after this little ceremony is over, none of those who are here present will be backward about trying the wines that are here spread out before you, and when you have tried them, I am sure you will like them. Perhaps it will induce you to come again, and some of you may see fit to settle among us, and therefore I say, you are invited, all of you, not all at once, but, rather, one at a time, to visit us in our homes among the vines, as I have already said, and I promise you once more, that you will find us generous of heart, and that you shall have a greeting full of all the hospitality that Californians can give.

At the conclusion of Mr. Estee's speech, Chairman Bundschu invited every one to partake of the collation which had been spread, and to wash it down with whatever kind of wine they fancied most.

After Mr. Estee had concluded and the tasting of the wines was begun, Mr. Bundschu was called on for an extemporaneous toast, and he responded as follows:

Responding to the kindly remarks propounded by Hon. M. M. Estee, in recognition of the efforts of the Building Committee, I can only say, I thank you. Whatever services may have been rendered to secure success, they were cheerfully given for the furtherance of a noble cause: the promotion and dignified representation of California's greatest industry at this Midwinter Fair.

If any one were lacking in flow of eloquence to express a sentiment in response to a toast (which is my case), all he might be expected to do under such genial circumstances would be to glance about and fasten his eyes over this cellar entrance, where these huge and beautiful casks stand out boldly and impressively like sentinel domes in Yosemite Valley. Here the suggestion greets us:

"Too much you can touch,  
But never enough—if good be the stuff."

Our hospitality to every one to-day is unbounded and unrestricted, but it may be well for us all to be mindful of our poet's mysterious advice. Right here before me I note a pleasant sentiment truthfully expressed:

"Here amidst bright eyes and faces,  
Here sorrow cannot reach."

Of course not; how should it? Where "bright eyes and faces," where "graces and laces" pay homage to our noble sovereign "Bacchus," joy, merriment, and laughter are the order of the day, and they will reign. Still, here on the south side, over this lovely panorama of the Golden Gate, with the halo of the setting sun in the distance and the vineyards of Goat Island in the foreground, the legend is spread:

"Hail, California, glory to thee!  
Nature's great wonder, noble and free."

And I can add nothing further to this glorification of the land of the setting sun but the sincerest wish that our good, great, and noble country, our beloved California, may be happy and prosperous forever.

The festivities continued until about 6 o'clock, interlarded by the national songs of America, Germany, France, Italy, and other countries, and music by the orchestra.

### INSTRUCTIONS TO JURORS.

As will be seen by the report of Mr. J. R. Baker, who was in charge of the display, the "Palace" was visited by many thousand people in spite of its rather unfavorable location. For particulars, reference is made to the report of Mr. Baker.

The viticultural exhibitors were naturally anxious about the system of making the awards. After a rather trying experience at Chicago, this feature was closely watched here, and the instructions which were formulated by Mr. Arpad Haraszthy were evolved after long study. They were in every way satisfactory to the exhibitors, and if only as a model for future exhibitions they should be republished here.

### INSTRUCTIONS TO THE JURY OF AWARDS, MIDWINTER FAIR.

#### DEPARTMENT A, GROUP 20.

*Gentlemen Jurors:* Recognizing the several and specific qualifications which so eminently fitted you to be Jurors in Group 20, Department A, the Administration of Awards of the Midwinter Fair, with full confidence in your knowledge, judgment, and perfect impartiality, has appointed you with full power to act in that delicate and most important capacity. Knowing that you will fill your self-accepted task with justice to the competitors, credit to the Administration, and honor to yourselves, I offer as a guide the following classification, general rules, and suggestions, with the request that they be followed as closely as possible by each of the sub-groups. Your time being limited, it will be well to begin your labors at once and bring them to a speedy end.

The general classification of wines, both native and foreign, should be as follows:

Red Wines.  
White Wines.  
Sweet Red Wines.  
Sweet White Wines.  
Sparkling Wines—Natural Process.  
Sparkling Wines—Carbonized Process.  
Brandies.

These are to be again divided into the following types:

*Red Wines:* (1) Claret type; (2) Burgundy type; (3) Hungarian type; (4) Spanish type; (5) Italian type. The Spanish type of red wines will cover the red wines of Greece and Algiers.

*White Wines:* (1) Sauterne type, sweetish character; (2) Sauterne type, dry; (3) Rhine wine type; (4) Burgundy type (which covers the Chablis and other white wines of the Burgundy district).

*Sweet Red Wines:* (1) Oporto type; (2) Alicante type.

*Sweet White Wines:* (1) Tokay type; (2) Sherry type, dry; (3) Sherry type, sweet or mellow; (4) Madeira type; (5) Malaga type; (6) Sweet Muscat type; (7) Angelica type.

*Sparkling Wines—Natural Process:* (1) Brut type; (2) Dry, or extra dry type; (3) Sweet or fruity type.

*Sparkling Wines—Carbonized Process:* To be divided into the same types as those wines made by natural process. It will be the duty of the sub-committee of Jurors judging champagnes and sparkling wines to ascertain positively, if possible, whether the same were made by the natural process or by the carbonized process, and render their decision accordingly.

*Brandies:* To be classified according to age and to be tried upon their merits as understood and acknowledged by brandy experts.

The wines to be tried by the Jurors should be brought to their several proper temperatures before the trial begins. The red wine types should be from 60° to 65° Fahr. The white wine types from 50° to 57° Fahr. The sweet, red, and white wines from 65° to 70° Fahr. The sparkling wines from 40° to 50° Fahr. The experienced judge will recognize the necessity for these temperatures.



It is exceedingly important to have each class of wine tried in its proper glass. All of these should be thin, perfectly white, and every exhibitor should have his wine tasted from glasses of the same shape and size as that of his competitor, and no variation shall be permitted; all are treated alike. Regulation glasses for each type will be provided for the Jurors.

The wines should be tasted in a moderately cool room where the temperature is about 60°; otherwise full justice could not be done to the delicacy of many wines presented.

All bottles submitted to the Jurors must be carefully wrapped, so as to prevent any identification whatever. This will enable the Jurors to arrive at a decision based only upon the merits of the wine tried. The competing wines should be wrapped with the same kind of paper, without any mark or number thereon. Complete uniformity must be impartially maintained for every exhibitor. The removal of corks and capsules should be done by an attendant, so that none of the Jurors may notice or recognize any mark tending to indicate who the exhibitor is, thus giving the most convincing proof of absolute impartiality.

When the trial begins, the Chairman of the group of Jurors will order the first bottle presented for trial marked "1"; when a conclusion is reached as to merits, and after full notes are taken by the Secretary of each sub-group, then only the wrapper is to be removed and the label shown.

The points guiding the Jurors to reach conclusions of comparative merit will be the following: (1) Brightness of the wine; (2) Beauty of color or shades of color; (3) Perfection of bouquet; (4) Purity and delicacy of taste; (5) Quality of body; (6) Quality of savor; (7) Proper alcoholic strength; (8) Harmonious perfection of the whole.

In trial for sparkling wines the two following additional points must be considered: (9) Vivacity of sparkle; (10) Duration of sparkle. Each of these, if perfect, would be given 100; if not, a so much less numerical valuation as the Juror may indicate. Afterwards an average is to be struck of the sum total, which, divided by eight for still wines and ten for champagnes, will stand as the credit of the wine in question.

The amount of wine to be placed at the disposal of Jurors, for dry wines, sparkling wines, sweet wines of each type, and brandy, must not be less than two quart bottles, with the privilege of drawing two more to set at rest any question that might arise.

Each of the sub-groups should elect from its number a Secretary, whose duty it will be to make full notes of all its proceedings, and to report credits given by said sub-committees to each wine of competing exhibitors, and at the end of its labors to hand a copy of the same to the Secretary of the Committee of the Whole, for the use of the Chairman and Secretary to make their final report to the Committee on Awards.

It is unnecessary to state that no competitor should be present at the trial of his wines, and that each day's proceedings should be kept strictly secret until the final report of the Committee of Awards is made public.

Regarding California wines, it may be well to draw attention to the fact that there is now grown in our State every European variety of wine and table grapes planted on soils of every known kind, either on mountain or plain, with every possible exposure and under widely differing climatic conditions, ranging from the semi-tropical temperature of our great valleys, in the south and interior, up to the very edges of our snow-capped mountains. It is not to be wondered, therefore, that many wines are grown in the above varying conditions that in a measure resemble the types and broad characteristics of those grown in the several European countries. These conditions existing, our California wine producers, without any attempt at imitation, have tried to approach the general good qualities of the above European types of wine by careful handling and the planting of the most renowned varieties of grapes; and it will remain for you to determine how near our wine growers have approached the general type claimed or how far they may be away from it.

In passing upon the California wines the Jurors should be guided solely by the claim set forth on the label by the competing exhibitor as to classification of type, etc.

While trying California wines the Jurors should also consider whether the same are bottled in bottles properly belonging to the type it is claimed they represent; that is to say, claret in claret bottles, sauterne in sauterne bottles, rhine wine in regular rhine wine bottles, burgundy in regular, or apparently regular, burgundy bottles. The more or less neatness of label, capsule, and general get-up should also be considered, and remarks favorable or otherwise made note of; these latter should not, however, increase or detract from the number of credits previously given the exhibitor for his wine or wines.

The above suggestions and rules are offered in the spirit of fairness for all exhibitors. The condition creating their necessity is well known to competent wine judges, and it is hoped that they will be followed as closely as the circumstances will warrant. All that we desire is that the wines, whatever country they may come from, or whoever the exhibitor may be, should be impartially judged and passed upon under the most favorable circumstances.

Respectfully submitted,

ARPAD HARASZTHY,  
Chairman.

P. S.—At the suggestion of well-known brokers and importers of foreign wines, it has been deemed best not to cover with a wrapper the foreign red and white dry wines and brandies, but to leave the same open for inspection and to be considered by the Jurors selected for their examination. No exception, however, will be made for foreign champagnes; they are to follow rigorously the rule demanding their wrapping up effectually, as indicated.

## THE AWARDS.

The following awards were made in the Viticultural Section of the Midwinter Fair :

## AMERICAN SECTION.

Arpad Haraszthy & Co., San Francisco, first, Eclipse, Extra Dry, Brut, and Carte Blanche champagnes.

Paul Masson, San José, second, Sauterne, Burgundy, Pinot variety, and champagnes.

Antonio Domenici, third, California champagnes, carbonated.

H. R. Schell, Knight's Ferry, second, grape brandy.

The Natoma Vineyard Company, Natoma, first, California grape brandy.

B. H. Upham, Martinez, third, California claret, Alicante.

Edward E. Goodrich, Santa Clara, second, California claret, Carignan.

A. Brun & Co., Oakville, first, California white wine, Semillon.

J. L. Beard, Warm Springs, second, California wine, Zinfandel.

Margherita Vineyard, Fresno, second, California red wines, Burgundy types, and Port wine.

A. Repsold & Co., San Francisco, second, California wine, Tokay type.

Dresel & Co., Sonoma, first, California wines, Zinfandel and Riesling.

I. De Turk, Santa Rosa, first, California wines, Zinfandel and Burgundy.

C. A. Wetmore, Livermore, first, California white wines, Sauterne types.

John Crellin & Sons, Livermore, first, California white wines, Hock type.

William Wehner, Evergreen, first, California white wines, Yquem type.

A. Grimm & Co., Calistoga, first, California white wines, Hock and Sauterne types.

C. K. Kirby, Fowler, first, California white wine, Sauterne type.

J. D. Peters, Atwater, third, California Port wine.

F. W. Billings, Redwood City, second, California red wine, Mondeuse, and California white wine, Sauvignon Vert.

Barton Estate, Fresno, second, California Port wine.

George West & Son, Stockton, first, California white wine, Sauterne type, grape brandy and Port wine.

Jacob Schram, St. Helena, first, California white wines, Schramsberger and Riesling.

Beringer Brothers, St. Helena, first, California wines, Zinfandel and Muscat.

A. R. Scott, Santa Clara, first, California red wines, Zinfandel and Petit Pinot.

The Ben Lomond Wine Company, Ben Lomond, first, California red wine, Cabernet, and California white wine, Riesling.

The E. G. Lyons Company, San Francisco, first, California red wines, Cabernet and Burgundy types, and California white wine, Sauterne type.

H. W. Crabb, Oakville, first, California red wine, Zinfandel and Burgundy types, and California white wine, Chablis type.

Tiburcio Parrott, St. Helena, first, California red wine, Chateau Margaux type.

Fountaingrove Vineyard Company, Santa Rosa, second, California red wine, Cabernet Sauvignon.

C. A. Baldwin, Santa Clara, third, California red wine, Cabernet Franc, and California white wine, Sauvignon Vert.

Henry Hagen, Napa, first, California red wine, Bondola.

F. Korbel & Brothers, Korbel's Mills, first, California white wine, Zernosek.

William Palmtag, Hollister, second, California white wines, Riesling, Gutedel, and Sauterne types.

Italian-Swiss Colony, Asti, first, California red wine, Barbera.

Italian-Swiss Colony, Asti, second, California white wines and Sparkling Muscat.

St. Hubert Vineyard, Fresno, second, California Port wine.

California Wine Growers' Union, San Francisco, second, California red wine, Burgundy type, and California white wine, Sauterne type.

Eggers & Co., Fresno, second, California Port wine.

Kortum & Fuelscher, Calistoga, third, California grape juice.

Ewer & Atkinson, Rutherford, non-alcoholic grape juice.

California Grape Food Company, Los Gatos, second, Sanitas grape food.

J. H. Yerrington, third, currant wine.

## REPORT OF CHARLES BUNDSCHU,

Treasurer and Chairman of the Building Committee.

SAN FRANCISCO, September 4, 1894.

*To the President and Members of the Executive Committee of Viticultural Exhibitors of the California Midwinter International Exposition, San Francisco, Cal.:*

GENTLEMEN: After the labors connected with the Viticultural Palace have been closed, and the building and all its contents disposed of to the best possible advantage, I hereby beg leave to submit the following financial report:

RECEIPTS.	
From State Viticultural Commission.....	\$2,076 00
From San Francisco Wine Dealers' Association, first subscription.....	1,000 00
From San Francisco Wine Dealers' Association, second subscription.....	250 00
From contribution to Building Fund by the Finance Committee of the Midwinter Fair.....	500 00
From subscriptions to General Fund by merchants, growers, and friends.....	3,202 50
From assessments, San Francisco Wine Dealers' Association.....	50 00
From assessments, other parties.....	101 80
From sundry refunds.....	33 35
From commission on sales.....	104 52
From proceeds of auction sale of fixtures.....	121 75
From sale of building.....	130 00
	<hr/> \$7,569 92
DISBURSEMENTS (AS PER VOUCHERS).	
T. McLachlan, building contract.....	\$2,500 00
T. McLachlan, extras.....	391 00
E. A. Otto, contract for decoration.....	2,076 00
E. A. Otto, extras on same.....	500 00
Plumbing.....	52 00
J. J. and T. D. Newsom, architects.....	100 00
Fixtures and installation account and general sundries.....	570 30



Stationery and printing account .....	\$136 12	
Drayage and freight account .....	88 60	
Salary, Johnson and assistants .....	235 00	
Salary, J. R. Baker, January to August .....	605 00	
J. R. Baker, half commission on sales .....	52 26	
		<u>\$7,306 28</u>
Balance in bank .....		<u>\$263 64</u>
Besides the two subscriptions credited above in the general account, and amounting to .....		\$1,250 00
The San Francisco Wine Dealers' Association expended on their exhibit, for their own account, the sum of .....		<u>1,450 00</u>
Making the total of their expenditures .....		<u>\$2,700 00</u>

Owing to the liberality of the Executive Committee at the fair, in supplying the necessary electric lights, water, and guards free of charge, and besides assisting us in our financial difficulties by a cash contribution of \$500, we were enabled to successfully meet our obligations, and show at the present time a small balance in our favor.

In the estimation of your committee there is no doubt that the architects, Messrs. John J. and T. D. Newsom, and the contractor and builder, Mr. T. M. McLachlan, have jointly erected a handsome and representative building, especially adapted for exhibition purposes; and Mr. E. A. Otto, who held the contract for interior decorations, has carried out most faithfully and conscientiously the intentions and suggestions of your committee; it is evidently due to his artistic taste and ability that our industry received such a distinguished representation at the Midwinter Fair.

A difference of opinion between your committee and Mr. Otto, in reference to extra charges outside of the contract, led to a final understanding whereby a claim of \$1,141 25 was compromised for \$500, Mr. Otto graciously relinquishing his claim on the balance of \$641 25. We can only regret that in consequence thereof serious financial loss resulted to the artist, who bestowed so much intelligence and good will in the execution of his work.

The commendable and impartial methods under which the various complicated duties of our Superintendent, Mr. J. R. Baker, have been discharged, have earned for him the thankful appreciation of your committee and cheerful acknowledgment from all parties interested. His courteous and intelligent efforts to point out to the thousands of Eastern and local visitors of the Palace the merits and importance of our California viticultural products, without preference to individuals or partiality to districts, would have entitled him to a more substantial recognition than our limited resources could afford.

We also owe an expression of sincerest thanks to all the officers of the California Midwinter Fair—first of all to the Director-General, M. H. de Young, Esq.—for their hearty coöperation; to the members of the Executive Committee, for their most generous and valuable assistance on all matters of importance; to Prof. E. E. Smith, Chief of the Horticultural Department, and to Mr. F. A. Haber, Chief of the Viticultural Bureau, for their untiring cordiality in support of our interests. We also allude to the efficient services of Lieutenant Hassen, Chief of the Electrical Department, in connection with the elaborate display of light in the Palace, and to Captain Baldwin's kind protective supervision of our exhibits as Commander of the Midwinter Fair Guards. We finally express our thanks to Arpad Haraszthy, Chairman of the

Committee on Awards, and to all the members of the jury, for their careful and impartial labors and their earnest endeavors to recognize the praiseworthy progress and development of our industry.

This comparatively limited effort in the direction of consolidation and mutual support has demonstrated beyond doubt that concert of action and fairness of purpose must accomplish beneficial results. Let us hope that all future attempts to benefit or resuscitate viticulture in California will be carried out on similar principles of mutual harmony and good fellowship.

Respectfully submitted.

(Signed:)

CHARLES BUNDSCHU,  
Treasurer and Chairman of Building Committee.

### REPORT OF J. R. BAKER,

In charge of Viticultural Palace.

219 SIXTH AVENUE, )  
SAN FRANCISCO, September 2, 1894. }

*To the Executive Committee of the California Wine Exhibit, California Midwinter International Exposition:*

GENTLEMEN: The concluding duty intrusted to me by you being fulfilled, namely, the sale of the "Palace of Viticulture," a brief review of the routine work accomplished at the recent exhibit may be acceptable to you.

Out of a total of seventy-eight subscribers (counting the ten members of the San Francisco Wine Dealers' Association individually), fifty-one made exhibits of wine, and five exhibited cooperage, apparatus, bottles, supplies, etc.

Up to the time of the opening of the exhibit, on April 6th, only fifteen of the growers and nine of the merchants had agreed to, or already had, supplied samples; so well satisfied, however, were our exhibitors with the attractiveness and business opportunities of the exhibit, that nine more of the growers availed themselves of the sample-room, making a total of thirty-three different brands on the list of samples.

During the 101 days the exhibit was open, April 6th to July 15th, 2,842 sample half-bottles and bottles—mostly the former—were dispensed to presenters of invitation tickets alone; in addition to this quantity over 1,000 bottles and half-bottles were dispensed on special occasions and to visitors unprovided with tickets, as shown by over 4,000 empty bottles returned to exhibitors. Twenty-one cases of wine were also presented to committees for special celebrations, such as Horticultural Day, Santa Barbara and other county celebrations; to the members of the Fair Committee, and to members of the press.

By actual count, on days of *average attendance*, we had an average of 600 visitors to the "Palace of Viticulture" per day, or over 60,000 during the whole term; the percentage of Eastern people and foreigners was a good one during April and May, but decreased thereafter. However, I made special efforts at all times that none of such strangers should escape without having proof of the quality of our high-grade wines, and some information as to varieties, brands, uses, etc.

Herewith I send you a list of the awards won by the exhibitors; also a copy of the "Instructions to Jurors," formulated by Mr. Arpad Haraszthy, Chairman of the jury, who at all times personally supervised their work.

Very little interest was shown by our exhibitors, at first, in the matter of awards, and only nineteen of the wine growers and makers entered for award up to shortly before the judging commenced. But as soon as the excellent personnel of the jury, and that the method of judging to be adopted was to be with the bottles masked and by points of merit, became known, which was mainly through my own correspondence—as the administration published no information on the subject—thirty-three of the forty-one growers and makers exhibiting in the "Palace of Viticulture" entered for award.

Out of the 84 dry white wines entered, 12 received first-class, 5 second-class, and 2 third-class diplomas.

Out of the 73 dry red wines entered, 12 received first-class, 6 second-class, and 2 third-class diplomas.

Among 36 entries for sweet wines, only 2 received first-class and 3 second-class diplomas.

The 6 entries of sparkling wines gained 3 first-class and 2 second-class awards.

And among 17 entries of brandy, there were 3 first-class and 1 second-class awards.

Mr. Emil Meyer, the Secretary of the jury, was especially careful that no wine entered should fail to be presented to the jury, and that the rules regarding marking the bottles and removal of caps and corks before presentation to the jury were strictly adhered to. The comparatively small number of awards proves the severe criticism by the jury, and the hard-won awards were fairly won.

The auction sale of the building and its furnishings was held July 19th, as advertised in the "Chronicle" of July 14th and 15th. The attendance was poor, but the furniture, etc., brought a very fair sum, \$121 75, the buyers being mostly our exhibitors, who desired souvenirs; but no offer was made for the building. Subsequently very few bona fide offers were made, and although I sought and interested several possible buyers, and twice an advantageous sale was nearly made to parties who could use the building and decorations in connection with the wine trade (most of the decorations being useless for any other purpose), yet the negotiations fell through, after much waste of time and effort on my part. The price finally obtained, \$130, may appear a small sum for such a beautifully decorated building, but in comparison with sales of other Midwinter Fair buildings, vastly larger than ours—such as Horticultural Building for \$700, Southern California Building for \$310, Northern California Building for \$260, etc.—the price obtained for ours is a fair one.

Trusting that material benefit will accrue to the California wine industry from our recent grand display in the "Palace of Viticulture"—for if the admiration and interest expressed by thousands of visitors count for anything, such benefit should reward your labors in behalf of the exhibit—and hoping that my humble services have been satisfactory to yourselves and the other exhibitors,

I am, gentlemen, respectfully yours,

(Signed:)

J. R. BAKER.



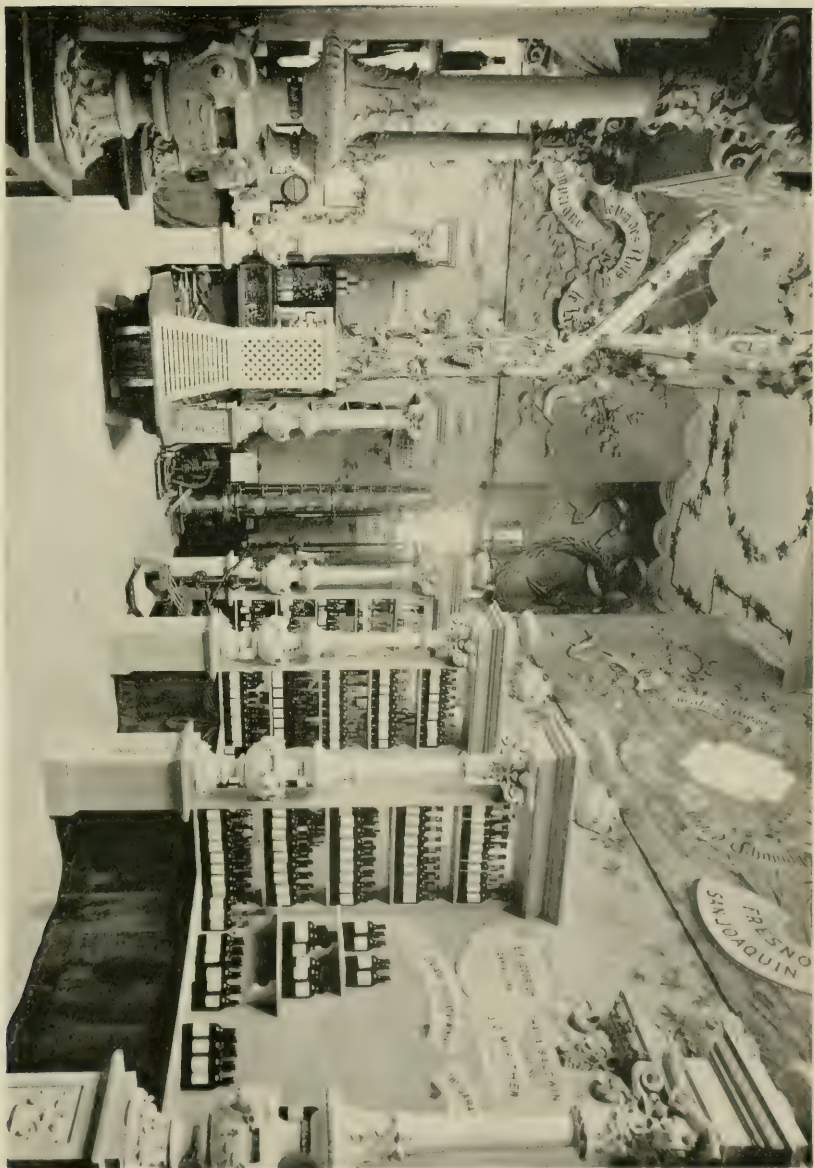
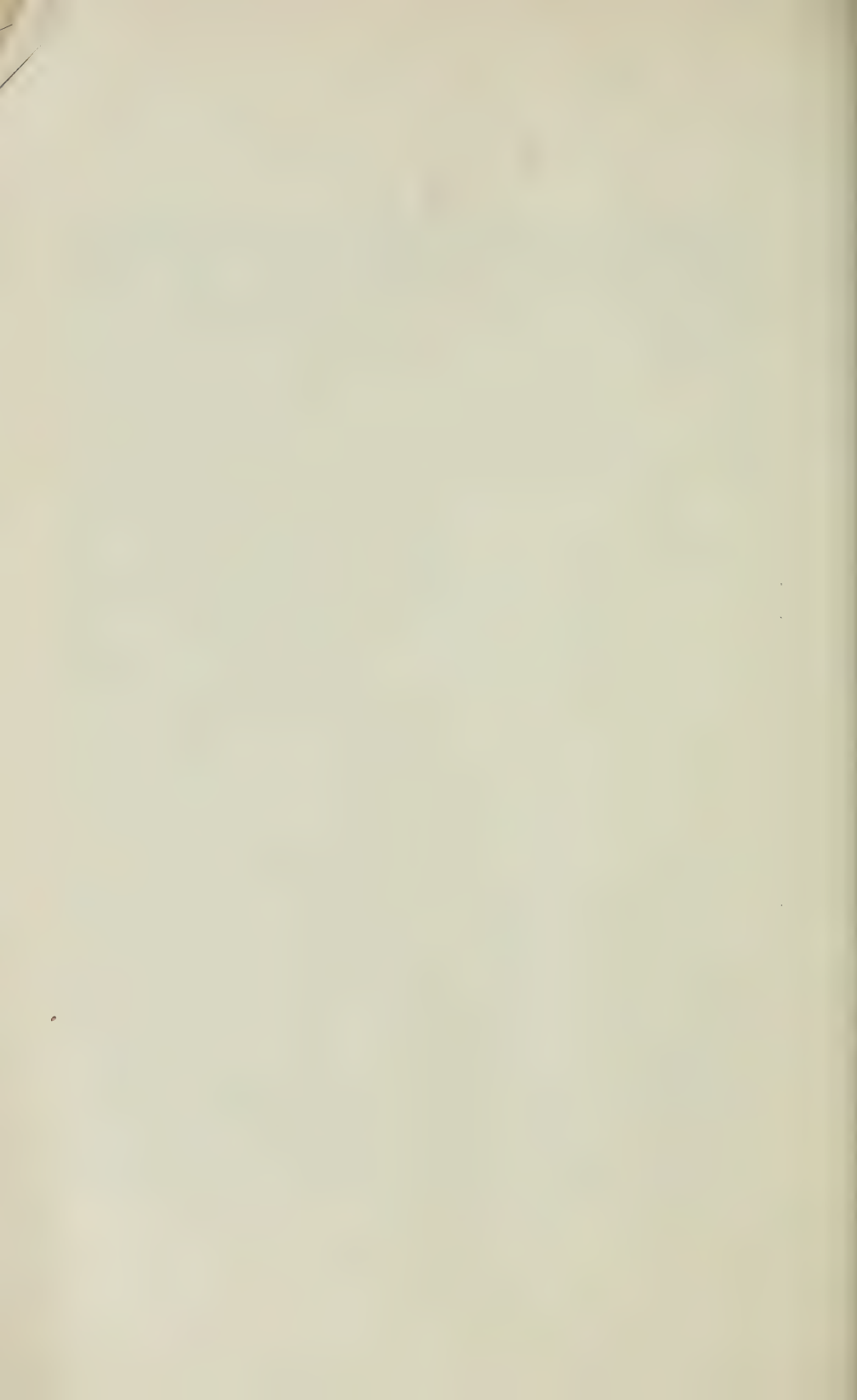


PLATE IV.—VIEW OF ONE SIDE OF THE DISPLAY.



## MINUTES OF VITICULTURAL EXHIBITORS.

A meeting of grape growers, wine makers, brandy distillers, raisin packers and growers, and others interested in viticulture, was held at the office of the Board of State Viticultural Commissioners on Friday, December 1, 1893, at 2 p. m., in pursuance of the following call:

SAN FRANCISCO, November 24, 1893.

DEAR SIR: At the request of a number of persons interested in viticulture, the Executive Committee of the Board of State Viticultural Commissioners authorizes me to call a meeting of the grape growers, wine makers, wine dealers, raisin growers and packers, and all other persons interested in the viticultural industry, for the purpose of adopting plans for a collective exhibit at the Midwinter Fair, such as will be a credit to all concerned and to the State.

This meeting will be held at the office of the Board of State Viticultural Commissioners, 101 Sansome Street, San Francisco, on Friday, December 1, 1893, at 2 p. m. At that time plans for exhibit will be presented and discussed.

Very truly yours,

WINFIELD SCOTT,  
Secretary.

Among those who responded were: I. De Turk, Santa Rosa; M. M. Estee, San Francisco; Albert Lachman, San Francisco; Charles Bundschu, San Francisco; Judge John A. Stanly, San Francisco; Henry Epstein, San Francisco; E. C. Priber, San Francisco; Chas. Kohler, San Francisco; Claus Schilling, San Francisco; P. C. Rossi, Asti and San Francisco; A. Sbarboro, Asti and San Francisco; B. M. Lelong, San Francisco; H. H. Sherwood, San Francisco; J. Ch. de St. Hubert, San Francisco; E. H. Rixford, San Francisco; C. J. Wetmore, Livermore; John Crellin, Livermore; Benj. P. Barker, Livermore; William Palmtag, Hollister; A. Malpas, Los Gatos; Wm. Wehner, Evergreen; Paul Masson, San José; E. E. Goodrich, Santa Clara; C. M. Mann, San Francisco; A. Korbel, San Francisco; A. Repsold, San Francisco; Pierre Klein, Mountain View.

The meeting was called to order by I. De Turk, of Santa Rosa, who stated that the objects of the meeting were to make some arrangements for a collective exhibit of wines and brandies at the Midwinter Fair.

On motion of Mr. Epstein, duly seconded, Mr. De Turk was elected permanent Chairman of the meeting.

On motion of Mr. Rossi, Mr. Scott was elected permanent Secretary.

Mr. De Turk called upon F. A. Haber, Chief of Viticulture at the Midwinter Fair, for a statement of what was proposed to be done. Mr. Haber made a long address, in which he stated that a fine display could be made for from \$10,000 to \$20,000, and he also submitted plans which he had prepared at his own expense.

In response to a query, Mr. De Turk stated that the Viticultural Commissioners could spend \$1,500 to \$2,000 for an exhibit, not of wines but of vines, etc. The Commissioners would cooperate in the main show.

Mr. C. J. Wetmore explained the mode in which such expenditure could be made.

In order to test the sense of the meeting, Mr. Bundschu moved that the exhibitors who went into the collective exhibit should not compete for awards. Seconded by Charles Kohler and discussed by M. M. Estee and others. On vote being taken the motion was lost.

Mr. Epstein then moved: first, that the exhibit be a collective one; second, that the exhibitors in such a display compete for prizes or not, as desired. Seconded, discussed, and carried.



Statements were then made that money was needed; that the time was short; and Messrs. De Turk and Haber called for subscriptions, it being understood that no one should be called on for the money unless the sum total was subscribed.

The following subscriptions were made:

Board of State Viticultural Commissioners .....	\$2,000 00
J. A. Stanly .....	100 00
Italian-Swiss Colony .....	100 00
F. Korbel & Bro. ....	100 00
I. De Turk .....	100 00
Inglenook Vineyard .....	100 00
H. H. Sherwood .....	100 00
John Crellin .....	50 00
A. Repsold & Co. ....	50 00
Wm. Palmtag .....	50 00
J. P. Smith .....	50 00
Wm. Wehner .....	50 00
Paul Masson .....	50 00
E. E. Goodrich .....	50 00
Capt. J. Ch. de St. Hubert .....	50 00
Los Gatos and Saratoga Wine Co. ....	50 00
B. H. Upham .....	50 00

Wm. Wehner moved that a committee of five be appointed by the meeting to act with the Viticultural Commissioners in preparing the exhibit, and to arrange details of making it. Carried.

The following were named and confirmed: P. C. Rossi, Wm. Wehner, A. Repsold, A. Malpas, and Henry Epstein.

It was moved and carried that this committee, with the Viticultural Commissioners, proceed with the collection of funds, and take charge of the matter generally.

After some further general discussion the meeting adjourned.

A meeting of the Executive Committee of the Exhibitors and Viticultural Commissioners was held at 4 p. m., Friday, December 1, 1893, at 101 Sansome Street.

Present: Viticultural Commissioners De Turk, Priber, and Bundschu, and Messrs. Rossi, Wehner, Repsold, Malpas, Epstein, C. J. Wetmore, and Scott.

I. De Turk called the meeting to order, and, on motion of Mr. Rossi, was made permanent Chairman.

On motion of Mr. Rossi, a committee of two was appointed to visit the wine merchants of San Francisco and solicit subscriptions. Messrs. Bundschu and Epstein were appointed.

On motion, Messrs. Wetmore and Scott were appointed a committee to prepare a circular letter to the people of the interior, soliciting subscriptions and telling of the action of the day.

On motion of Mr. Priber, Mr. Wetmore was requested to supplement this work with personal work in the counties, and the Chairman was instructed to appoint a committee of two or three in each county to aid in the matter.

The Chair stated that he would appoint the committees later, but the following partial committees were announced:

Santa Clara .....	Wm. Wehner and A. Malpas.
Sonoma .....	I. De Turk and P. C. Rossi.
Napa .....	E. C. Priber.
Alameda .....	C. J. Wetmore.

Mr. Epstein moved that whereas there appeared difficulty in obtaining sufficient funds for making a creditable collective exhibit of wines, etc., at the Midwinter Fair, a committee of four be appointed to wait on the proper Midwinter Fair authorities, with a view of obtaining suitable space for the display on the best possible terms. Carried.

Messrs. Epstein, Bundschu, and Wehner were appointed such committee.

On motion, it was decided to elect permanent officers, resulting as follows: President, I. De Turk; Vice-President, C. J. Wetmore; Secretary, Winfield Scott; Treasurer, Charles Bundschu.

At the request of Mr. Bundschu, an auditing committee, to consist of Messrs. Repsold and Epstein, was appointed.

Adjourned.

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SAN FRANCISCO, December 7, 1893.

A meeting of the San Francisco wine merchants and shippers was held at the office of the Viticultural Commission, 101 Sansome Street, December 7, 1893, at 2 p. m.

Among those present were Charles Bundschu, C. J. Wetmore, Wm. Wehner, H. Epstein, W. E. Stevens, Hans Kohler, R. J. Harrison, P. C. Rossi, Albert Lachman, J. J. Jacobi, Mr. Wertheimer, E. C. Priber, and Winfield Scott.

Mr. Scott called the meeting to order, and announced that the election of a permanent Chairman was in order.

Mr Epstein was nominated and elected.

Mr. Epstein made a statement to the effect that the San Francisco wine dealers had had a meeting the day before, and that they had decided to go into the exhibit in a body, providing they could be placed together. Their object would be to make a strictly commercial exhibit, and they did not care for prizes. He subsequently amplified this by stating that the dealers would contribute \$1,000 to the general fund, and bear the expenses of putting up their part of the display if the proposition was accepted.

Mr. Wehner said it was understood that there should be no segregation.

Arguments and remarks were made by Charles Bundschu, J. J. Jacobi, E. C. Priber, F. A. Haber, P. C. Rossi, and others, and the matter was finally disposed of by asking the Executive Committee of the Exhibitors' Association to call a meeting for Monday, at 3 p. m., at which time the dealers' proposition would be acted upon.

Adjourned.

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SAN FRANCISCO, December 11, 1893.

A meeting of the grape growers, wine makers, wine merchants, shippers, etc., was held this day at 3 p. m., at the office of the Board of State Viticultural Commissioners, in pursuance to a call.

Among those present were: I. De Turk, E. C. Bichowsky, George West, Hans H. Kohler, John A. Stanly, Capt. J. Ch. de St. Hubert, A. Repsold, Pierre Klein, F. Korbel, E. C. Priber, W. W. Lyman, P. C. Rossi, A. Sbarboro, R. J. Harrison, W. E. Stevens, B. H. Upham, L.

Wagner, Charles Bundschu, J. J. Jacobi, Henry Epstein, William Wehner, Paul Masson, C. J. Wetmore, F. L. Fowler, F. A. Haber, M. M. Estee, A. Lachman, E. E. Goodrich, and some others.

I. De Turk presided.

The minutes of the last meeting were read, and subsequently, for the information of all concerned, the minutes of the Executive Committee were read, as well as those of the meeting of San Francisco shippers and merchants.

Mr. De Turk called for a statement from the Wine Dealers' Association, as to what they propose to do at the Midwinter Fair in the collective exhibit.

Mr. Epstein, speaking for the dealers, said that the association proposed to donate \$1,000 to the common fund, and in addition to bear the expense of putting up their own portion of the exhibit; provided, that the merchants would not be separated and their individuality not lost; they would conform to the general plan, and would not compete for prizes.

In response to a query, Mr. Epstein said that the merchants would abide by the award of space made to them by the Executive Committee.

Mr. West moved the proposition of the Merchants' Association be accepted.

Remarks were made *in extenso* by Messrs. Epstein, Rossi, Stewart, Wehner, Stephens, Bundschu, and others. After an hour's discussion, Mr. Wetmore amended the motion of Mr. West, that all organizations and counties so wishing it, be given space and be individualized.

This was carried, as was also the original motion.

A statement was made that the subscriptions amounted to \$7,200, of which \$1,000 would come from the merchants, \$2,500 would be spent by them, \$2,000 from the Viticultural Commissioners, and \$1,600 from various subscriptions.

Additional subscriptions to those received at the previous meetings were recorded as follows:

San Francisco Wine Dealers' Association.....	\$1,000 00
Geo. West & Son.....	50 00
R. D. Stephens.....	50 00

Pierre Klein gave notice that he had withdrawn his exhibit.

The open letter to M. H. de Young, Director-General, from C. E. Bowen, was read, and, in addition, Mr. Scott read a letter of R. C. Terry, supporting Mr. Bowen's position.

The letter was discussed, and the resolutions of the Viticultural Commissioners in the premises were read.

Mr. Epstein moved that a committee of three be appointed to call on the Midwinter Fair authorities, and make an appeal that no wines be sold on the fair grounds except those exhibited and bearing producers' or legitimate dealers' labels. Carried.

The Chair appointed Messrs. Bichowsky, Epstein, and Rossi.

Mr. Epstein moved that the Executive Committee be empowered to engage such space as they may require to carry out the objects of this meeting; and to apply the funds already subscribed to pay for the space and to erect the exhibit. Carried.

Mr. Jacobi moved that one day be set aside as a Viticultural Day, late in the fair. Carried.

Adjourned.



SAN FRANCISCO, December 13, 1893.

Mrs. E. W. Scott, of Santa Clara County, this day subscribed \$50 to the Midwinter Fair Viticultural Fund.

SAN FRANCISCO, December 18, 1893.

## Additional subscriptions:

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John L. Beard.....	\$20 00
H. B. Wagoner.....	10 00
F. A. Haber, for Wilkins & Co.....	50 00
E. Schirmer.....	20 00
Charles Bundschu, for Landsberger & Son.....	50 00

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A meeting of the Executive Committee of the Midwinter Fair Exhibitors was held at the office of the Viticultural Commissioners on Monday, December 18, 1893, at 2 p. m., for the purpose of conferring with the San Francisco merchants.

I. De Turk presided and Winfield Scott acted as Secretary.

Among those present were Henry Epstein, C. J. Wetmore, Charles Bundschu, William Wehner, Hans H. Kohler, P. C. Rossi, I. De Turk, Claus Schilling, E. C. Priber, and Mr. Van Bergen; also F. A. Haber, Chief of Viticulture.

The minutes of the previous meeting were read and subsequently approved.

There ensued some discussion over the manner in which the State Viticultural Commission could expend its funds. In this discussion Messrs. Bundschu, Priber, Wetmore, Rossi, De Turk, and others participated, and finally, on motion, duly carried, the Commission was requested to make its contribution to the Midwinter Fair funds as large as it possibly could for the erection of the structure in which the exhibit would be displayed; and also to request Mr. C. J. Wetmore to go to Sacramento and make what arrangements he could with the State Board of Examiners for the expenditure of the funds.

Mr. William Wehner reported the following additional subscriptions from Napa Valley:

Tiburcio Parrott.....	\$100 00
Jacob Schram.....	50 00
Beringer Bros.....	50 00
Ewer & Atkinson.....	50 00
H. W. Crabb.....	50 00

Mr. Jacob Schram reported the following subscription:

A. Grimm.....	\$50 00
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Mr. Wehner reported that every one in the valley whom he had seen had contributed when the matter was properly explained. The question of space at the fair then came up. A motion was made authorizing the Treasurer to close for the space selected when the committee visited the Horticultural Building. This received no second.

Then a general talk ensued on the space. It was developed that the exhibitors could not now get the space they agreed to take when they

visited the Horticultural Building, and that certain aisles were to be closed and entrances to be changed.

This did not suit the majority of those present. Mr. Haber said that the space now offered was 40 by 64 feet. An hour's talk ensued, and then a committee of four was appointed to go to the Midwinter Fair headquarters and get some clear light on the question of space.

Messrs. Schilling, Rossi, Wehner, and Kohler, accompanied by Mr. Haber, proceeded to the Midwinter Fair headquarters, and the others waited for definite information.

On the return of the committee, Mr. Kohler reported that there was a width of 46 feet in the clear; that 10 feet of this had been given to Abramson & Heunisch for a cork exhibit; that there was a total of 1,440 feet available, for which \$1,800 was wanted; and that the means of getting at the space were blocked by various exhibits.

Mr. Wehner moved that the Exhibitors refuse to take space, for the reason that the space offered is not sufficient and not well enough located to make a creditable display of the industry. Seconded.

An amendment to pay \$1,800 for the space failed of a second, and then the original motion was passed unanimously.

Mr. Bundschu was appointed a committee of one to assist the Secretary in compiling a letter to the Director-General of the Exposition, apprising him of the action taken.

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Minutes of the meeting of the Executive Committee of the Viticultural Exhibitors, held at the office of the State Viticultural Commissioners, 101 Sansome Street, San Francisco, on December 20th, at 11 A. M.

I. De Turk presided.

Among those present were Albert Lachman, J. J. Jacobi, C. J. Wetmore, F. A. Haber, Charles Bundschu, J. J. Weglein, Henry Epstein, A. Repsold, Hans Kohler, Henry Van Bergen, John Crellin, A. Malpas, and C. Carpy.

The Chairman stated the object of the meeting to be the consideration of a project to erect a suitable separate building for viticulture at the Midwinter Fair.

Mr. Bundschu made an elaborate statement of the course of events from the beginning until the present. He thought that the erection of a suitable building was the only recourse now open, and said that a committee, himself one of the number, had assurances from the Director-General that if such a building was erected, those who exhibited in it would have the same rights and privileges as the exhibitors in the main building, and besides would not have to pay ground rent.

Mr. O'Shaughnessy and Mr. Haber, of the Midwinter Fair, were present, and showed the ground plans of the spaces that were proposed.

After some discussion, a motion was made by Mr. Rossi, seconded and carried, that the space 45x60 feet, or thereabouts, west of the Horticultural Building, be accepted.

A motion was made, seconded, and duly carried, that the Chairman of the meeting, the Secretary of the meeting, and the State Viticultural Commission, and the Chief Executive Officer of the State Viticultural Commission sign the necessary papers to secure the space.

On motion of Mr. Al. Lachman, duly seconded and carried, a Build-

ing Committee of three was authorized to take charge of putting up the building.

The Chair appointed Messrs. Wetmore, Bundschu, and Epstein.

Mr. Wetmore stated that he would go to Sacramento and confer with the State Board of Examiners in relation to approving the bills that the Commissioners might incur in putting up the building.

On motion of Mr. Priber, a committee of two was appointed to accompany Mr. Wetmore to Sacramento and see if bills to the amount of \$3,000 would be approved out of the Commission's funds. Messrs. West and De Turk were appointed.

On motion of Mr. Priber, a committee of three was appointed to petition the State Viticultural Commission for from \$3,000 to \$5,000 from its appropriation. Messrs. Priber, Bundschu, and Wehner were appointed.

David Woerner, through a member present, contributed a cask of 1,500 gallons (about) to the exhibit.

Mr. Haber called attention to the fact that Captain Niebaum had considerable material that would be exceedingly desirable for the exhibit.

On motion, Mr. Bundschu was appointed a committee of one to see Captain Niebaum in reference to the matter.

An appropriation of \$50 was made to secure names petitioning the State Board of Examiners to audit bills of the Viticultural Commission for building the Viticultural Building.

Several plans for an exhibit, among them those of Capt. J. Ch. de St. Hubert and Mr. Wolf, were referred to the Building Committee.

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SAN FRANCISCO, January 16, 1894.

Additional subscriptions:

Sanders & Co. (per C. J. W.).....	\$50 00
M. M. Estee (per C. J. W.).....	50 00
C. J. Wetmore.....	30 00
Lenormand Bros.....	50 00

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Minutes of the meeting of the Building Committee of the Viticultural Exhibitors, held at the office of the Board of State Viticultural Commissioners, 101 Sansome Street, San Francisco, on January 19, 1894, at 2:30 P. M.

Present: Messrs. Henry Epstein, Chas. Bundschu, C. J. Wetmore, F. Korb, Wm. Wehner; also Mr. E. C. Priber, and afterwards P. C. Rossi. Winfield Scott acted as Secretary.

After some discussion, Mr. Epstein moved that Chas. Bundschu be permanent Chairman. This was seconded by C. J. Wetmore, and carried.

Prior to the regular order of business, there was an informal discussion as to where the merchants (in the San Francisco Wine Dealers' Association) should have space allotted in the Viticultural Building. Mr. Priber, representing the merchants, and Messrs. Bundschu and Epstein, also of the Association, asked for space along the north wall, leaving the center for a collective exhibit of producers, an attractive center-piece, a fountain, or anything desired. They said they did not



want the producers to think that the merchants wanted undue favors or prominence, and that the Association would be content with a side space.

When the regular order of business began, Mr. Wehner asked that the allotment of space to the San Francisco Wine Dealers' Association be taken up. He therefore moved that the center space, under the dome, up to 20x20 feet, be allotted to the Wine Dealers' Association, they agreeing to bear the expense of putting up the exhibit, and to make it harmonious with the rest of the display.

F. Korbel seconded the motion.

Speaking for the merchants, Mr. Epstein stated that they would prefer the side, so as to avoid any possible ill-feeling.

Mr. Priber, for the merchants, spoke in a similar strain, adding that the side would be appreciated much more thoroughly; that they already had a fine picture for the side, and would improve it; and that while not speaking from authority, he might say that if the merchants got the side space, they might contribute \$1,000 to the general fund. In answer to an inquiry, he said of necessity the merchants would do something toward fitting up the wine-room.

Mr. Epstein offered an amendment that the merchants be allotted the entire north wall, or as much of it as the committee saw fit.

Seconded, but lost.

The original motion was put and carried.

Mr. Priber stated, after the vote, that the merchants reluctantly took the space.

Plans for interior decoration were then called for.

Messrs. Wolf and Newsom, who were in waiting, were called in and their plans were examined and discussed. They were asked to submit an estimate for their plans with the center-piece left out. After a few minutes they returned and stated that their bid without the center-piece would be \$2,800, Mr. Wolf being spokesman.

Mr. Wehner asked if they had any changes to offer in the design. Mr. Wolf replied negatively.

In the meantime Mr. Otto submitted his plans, specifications, and estimates. He also agreed to fit out the passageway for \$75 additional, though not to put up shelves for exhibits.

Mr. Otto's bid, according to his plans, was for \$2,001, substituting twenty-four stands around the sides, instead of thirty-two.

Mr. Wehner moved that the plans and specifications, as submitted by Mr. Otto, at the prices given, \$2,076, including a harmonious and artistic decoration of the hallway leading to the Horticultural Building, be accepted.

The motion was seconded and carried.

Mr. Wehner moved that the Chairman be charged with communicating with Mr. Otto, and completing the contract with him in a proper and business-like manner, requiring bonds to cover the amount specified in his bid.

The motion was seconded and carried.

On motion, the Secretary was instructed to notify Mr. Wolf of this action in writing.

Mr. F. A. Haber, who had arrived some time previously, proposed that the Viticultural Building be opened with suitable ceremonies. He



PLATE V.—VIEW IN THE INTERIOR OF THE WEINSTUBE.





explained that he was going to New Orleans on the 28th, and would probably not be back until February 20th.

On motion, consideration of the proposition was deferred for the present.

Adjourned.

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Minutes of the meeting of the Executive Committee of Viticultural Exhibitors, held at the office of the Board of State Viticultural Commissioners, San Francisco, February 1, 1894, at 11 A. M.

Present: I. De Turk, who presided; C. Carpy, E. C. Priber, Charles Bundschu, C. J. Wetmore, Hans H. Kohler, Henry Epstein, P. C. Rossi, and F. Korbel.

Winfield Scott acted as Secretary.

The reading of the minutes of the preceding meeting was dispensed with.

Mr. Bundschu reported that the contractor of the building was present and wanted some arrangements made as to building the stairway from the Horticultural Hall to the Viticultural Palace. He said that it was necessary that these matters be settled.

Mr. Bundschu also reported that he had agreed to pay the architect \$100 for his services; that \$1,500 on account had been paid the builder, on Mr. Korbel's statement that work to that amount had been done; and that the Portuguese exhibitors wanted to run an archway toward the stairs; that \$61 25 would be the extra cost of fixing the passage way referred to with rough lumber.

On motion, the proposed offices and ladies' room were dispensed with.

On motion, the following action of the Building Committee was approved: Boarding the walks, \$60; expense in cutting into Horticultural Building, \$61 25; finishing archway, etc., in accordance with McLachlan's specifications, \$236.

On motion, the Chairman of the Building Committee was instructed to go ahead with these extras.

Mr. Wolf's threats to make things uncomfortable for the committee were discussed, but no action was taken.

Mr. Scott was instructed to write for passes for the committee.

Adjourned.

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Minutes of the meeting of the Executive Committee, held at the office of the Viticultural Commissioners, 101 Sansome Street, on March 6, 1894, at 11 A. M.

Present: I. De Turk, who presided; Messrs. Bundschu, C. J. Wetmore, Wehner, Crabb, Rossi, Korbel, Epstein, and Repsold; also the Secretary, and by invitation, Messrs. Otto and Baker.

Mr. Bundschu made a long verbal report from the Building Committee: that good progress was being made on the Viticultural Palace; that the building had been turned over by the builder; that some damage had been done by water leaking through the dome; that the builder claimed that certain changes made in the plans of the dome would exculpate him from damages, and that gutters were needed on the building.

After some discussion, Mr. Bundschu was, on motion of Mr. Epstein, authorized to pay the bills for construction account, reserving \$600.

The question of awarding space to counties and individuals in the "Palace" was then brought up. After a discussion, Mr. Epstein moved that a committee of five be appointed to act, with the Chairman representing Sonoma County.

The motion was carried, and the following committee was appointed to act in the afternoon.

Sonoma—I. De Turk and P. C. Rossi. Napa—H. W. Crabb. Alameda—C. J. Wetmore. San Francisco—Henry Epstein. Santa Clara—Wm. Wehner.

Mr. Bundschu called the attention of the committee to the fact that Charles G. Lathrop, representing the Stanford estate, had refused to contribute to the viticultural fund; also James G. Fair, Mrs. Hearst, E. J. Baldwin, and others. He thought that the Stanford estate, which had been enriched by the wine men in part, should have been in evidence. No action was taken.

The Secretary was, on motion, instructed to write to the Director-General in regard to passes for the members of the committee who are exhibitors.

The Secretary was instructed to remind the Executive Committee and Director-General that \$750 was coming to the viticultural fund for relinquishing space in the Main Horticultural Building.

On motion of Mr. Epstein, the Building Committee was empowered to retain Mr. Baker's services, to take charge of the exhibits as they arrived.

Adjourned.

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Minutes of the meeting of the Executive Committee of Exhibitors, held at the office of the Viticultural Commissioners on March 15th, at 3 P. M.

Present: Mr. C. J. Wetmore, who presided; Messrs. Epstein, Rossi, Bundschu, Schilling, and West, also Mr. J. E. Baker.

Mr. Bundschu stated that the meeting was in regard to future control of the Viticultural Palace, Mr. Emory E. Smith, the Chief of the Department of Horticulture, claiming it.

After further statements by Mr. Bundschu and Mr. Baker and a general discussion, the Secretary was, on motion, directed to write to Mr. Smith, and ascertain when a committee could call on him and Mr. Haber, with regard to this matter.

The following committee was appointed to act: P. C. Rossi, C. Schilling, Henry Epstein, Charles Bundschu, and C. J. Wetmore.

Adjourned.

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Minutes of the meeting of the Executive Committee of the Viticultural Exhibitors, held at the office of the State Viticultural Commissioners on April 3, 1894.

Present: C. J. Wetmore, who presided; E. C. Priber, who acted as Secretary; Henry Epstein, P. C. Rossi, A. Repsold, and Charles Bundschu.

The following programme on the occasion of opening the Viticultural Palace on April 7th was agreed on:

- 2:00 P. M. Overture by the orchestra.  
 2:15 P. M. Remarks by Charles Bundschu, Chairman of the Building Committee, on turning over the building to exhibitors.  
 2:30 P. M. Remarks by I. De Turk, Chairman of the Viticultural Committee accepting the building for the exhibitors.  
 2:45 P. M. Address by Director-General M. H. de Young, on behalf of the fair management.  
 3:00 P. M. Remarks by Hon. M. M. Estee (in place of Judge J. A. Stanly, declined, on account of inability to be present).  
 3:15 P. M. Remarks by F. A. Haber, Superintendent of Viticulture.  
 3:30 P. M. Lunch.

On motion, the sum of \$50 was set aside for supplying lunch (sandwiches), and Messrs. Epstein and Priber were given charge of the matter.

On motion, Charles Bundschu was appointed the committee to supply the wines.

On motion, Messrs. C. J. Wetmore, Bundschu, and Epstein were appointed the committee on invitations, with power to act.

On motion, the payment of the building contractor and decorator, E. A. Otto, in full, was authorized.

The Treasurer (Bundschu) submitted a statement showing a balance of \$841 in the treasury.

The San Francisco Wine Dealers' Association agreed to pay \$250 towards defraying the contingent expenses of the exhibit.

On motion, a Supervision Committee of fifteen was appointed to look after the building, the members to act in sub-committees of three, each sub-committee to act one week in rotation.

April 8-14 (1st week)—Bundschu, Wetmore, DeTurk.

April 15-21 (2d week)—Priber, Scott, Parrott.

April 22-28 (3d week)—Schilling, Carpy, West.

April 29-May 5 (4th week)—Epstein, Repsold, Beringer.

May 6-12 (5th week)—Rossi, Korbel, Wehner.

Giving two members in sub-committees in the city.

The Secretary was directed to communicate with these gentlemen.

On motion, Messrs. Bundschu and Priber were appointed a committee of two to draw up rules to govern the sampling-room, and confer with Superintendent of Viticulture Haber in regard to the rules.

Adjourned.

Minutes of the meeting of the Building Committee of the Viticultural Exhibitors, held at the office of the State Viticultural Commissioners, 101 Sansome Street, San Francisco, May 1, 1894, at 11 A. M.

Present: Charles Bundschu, in the chair; and Messrs. Priber, C. J. Wetmore, Epstein, Schilling, and the Secretary; also decorator E. A. Otto.

Mr. Bundschu stated that he had been surprised, on the presentation of Mr. Otto's bill for extras, to note the size of the charges. The bill (which was duly laid before the committee) called for additional expenditure of over \$1,100, and there was no money to pay them. He suggested an examination of the separate items. The main contract had been completed and paid.

Mr. Otto made a statement, in response to an inquiry by Mr. Priber, that all the extras had been ordered by either Messrs. Bundschu, Epstein, or Priber.



This led to a call for particulars from each of these gentlemen. Each said that he had expected that some extras would be needed, but all that Otto had charged for had certainly not been ordered.

Mr. Otto made a supplementary statement, stoutly asserting his position in the premises. Subsequently he admitted that he himself had been surprised at the amount of the extras.

Mr. Priber asked if it was not a fact that the committee had tried from time to time to find out what these extras would cost, and had been unable; and further, if it was not a fact that the committee would never have ordered costly extras had Otto been able to give a statement. Mr. Priber received no satisfactory answer.

A general discussion followed, in which Messrs. Bundschu, Priber, and Epstein claimed that Otto had gone ahead in many instances without authority, and in all cases without stating cost.

Finally, the matter was brought to an issue after Mr. Otto had withdrawn, by Mr. Priber moving that the bill for extras be referred to a special committee of two, consisting of Mr. Bundschu and Mr. Epstein, who were instructed to go through Mr. Otto's bill and ascertain: First, what items in it were covered by the original contract; second, what items were unauthorized; and third, what duly authorized were too high.

The motion was carried.

The committee then adjourned.

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A meeting of the Executive Committee of Viticultural Exhibitors was held September 12, 1894, at 101 Sansome Street, San Francisco.

Present: Vice-President C. J. Wetmore, who presided; and Messrs. Bundschu, Korbel, H. H. Kohler, and Epstein.

The final reports of Charles Bundschu, Treasurer and Chairman of the Building Committee, and of J. R. Baker, were read and ordered filed.

On motion, a vote of thanks was extended to the Building Committee for its efficient work.

On motion, a vote of thanks was extended to Charles Bundschu for his faithful services to the cause as Treasurer and as Chairman of the Building Committee.

On motion, Mr. J. R. Baker was given a vote of thanks for his work and efficiency as Superintendent.

The question of the distribution of the funds was brought up.

It was decided to pay Mr. Baker \$63 64 for his work in September, in winding up the affairs of the display.

On motion, the sum of \$100 was voted to Mr. E. A. Otto, the decorator, whose claims for extra services had been compromised at a loss to him.

On motion, the sum of \$100 was set aside to be expended by the Treasurer in procuring photographs of the "Palace" and interior, for the members of the committee.

There being no further business the committee adjourned.

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APPENDIX D.

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THE PHYLLOXERA OF THE VINE.

By VALERY MAYET.

[Translated for the Board of State Viticultural Commissioners.]

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# THE PHYLLOXERA OF THE VINE.

*Phylloxera vastatrix*, Planchon.

SYNONYMS.—*Pemphigus vitifolii*, Asa Fitch, 1854; *Dactylosphæra vitifolii*, Schimer, 1867; *Perilymbia vitisana*, Westwood, 1867; *Rhizaphis vastatrix*, Planchon, 1868. (See bibliography after the chapters on phylloxera.)

## INTRODUCTION.

To write on a subject after so many other authors, and to summarize and recapitulate the mountains of books, treatises, memoirs, notes, and pamphlets concerning it, offers many difficulties. Such is the situation, however, of whomsoever desires to-day to write upon the phylloxera. Ordinarily when one wishes to treat upon any subject and to get at the beginning or origin of the matter, one is oftentimes at great trouble to seek out the earlier works; and on the day of publication, often too late, come other documents which the writer would have been glad to use.

However, with the phylloxera, the abundance of material becomes almost an obstacle. It is true that some researches were made in past decades, but the investigations virtually date back twenty years; but during this short period what floods of ink, what outbursts of impracticable ideas, what foolish plans have been devoted to securing the prize of 300,000 francs offered for a remedy! M. Planchon writes:\*

"In order to get any correct idea in this torrent of fantastic lucubrations, it is only necessary to remember the ignorant notions that prevailed. Some said that it was necessary to have a toad buried under a stump in order to get from him the nature of the venom that would attack the phylloxera-infested vines; and people will recall how attacked vines were sprinkled and soaked with white wine or a decoction in which mauve was the principal constituent. In the deluge of processes, many of the experimenters had confounded the phylloxera and oidium, or had never seen one or the other of these parasites. The combined spoliation and silliness undermined, to a great extent, the confidence of the masses in scientific instruction. Speculations and fancies came to us from all social ranks and from every corner of Europe. The better class of those who made recommendations to the Minister of Agriculture were generally the most ignorant; and they were the most tenacious when their ideas bordered closest to folly. Happily, in proportion as observation and experience approached the problem, the dreamers passed to the background, trifling discussions gave way to a study of the facts, and useful investigations were concentrated on obscure points, letting in a full light upon them, admittedly clear by science."

Let us do the same. Let us leave on one side, as far as possible, the secondary naturalists, the empiricists, the seekers of theories and panaceas, and draw from the writings of the standard authorities. The history with which we begin will be taken, in great part, from the *Comptes rendus* of the Academy of Sciences, a valuable source of information.

\*J. E. PLANCHON: *The Phylloxera Question*. (*Revue des Deux Mondes*, January 15, 1887.)



## CHAPTER I.

## HISTORICAL.

The order of phylloxera was created in 1834 by Boyer de Fonscolombe.\*

And the first species observed at this time in the vicinity of Aix (Bouches-du-Rhone), the *Phylloxera quercus*, were found living on the oak. This insect, fixed under the leaves of the tree, produces by its attacks a partial desiccation of the leaves; and when it multiplies sufficiently, the entire leaf becomes dry. The etymology is φύλλον (leaf) ξηρειν (dry or desiccate). This is very exact as far as most of the species are concerned, living as they do on the oak and walnut, but it is different with the species which attack the vine; in its mode of life it forms an exception to the other species of the order.

It was in 1854 that the phylloxera of the vine was first spoken of; the species discovered in the United States in the galls on the leaves by Dr. Asa Fitch† was discovered by that naturalist and named *Pemphigus vitifolii*. Dr. Henry Schimer, of Philadelphia, in 1867 discovered the same gall and same insect, but this time in two different forms: the wingless gall insect and the winged insect. These were separated from the *Pemphigus* for the reason that the hairs at the ends of the tarsi terminate in a sucker, and the American naturalist called the insect the *Dactylophæra vitifolii*. (See Annals of Society of Natural Sciences of Philadelphia.) However, in 1863 the species described by Asa Fitch had passed over the Atlantic and was found by Westwood in the graperies at Hammersmith, near London, England. The celebrated professor from Oxford met first the gall insect; but thinking of examining the roots of the vines, he discovered the root form of the insect, until then unknown. Some years afterward (1867–1868) the insect was noticed in many parts of England and Ireland. The English savant described the insect, under the name *Peritymbia vitisana*, to the Ashmolean Society of Oxford, November 21, 1867.

While the insect was thus established at many points in England, the dying of the vines from it was noticed at the same time in many portions of France, the cause not then being known. We find in the *Revue Agricole et Forestiere de Provence* of March 5, 1868, a letter written by M. Delorme, a veterinary of Arles, under date of November 8, 1867, and addressed to the President of the agricultural meeting of Aix—a letter in which it is stated that the disease was noticed in Crau-d'Arles in the month of July, 1867. M. Delorme was the first to write in any French publication of what was then called “the new disease of the vine”; but it appears that the malady had secured a foothold as early as 1863 in the commune of Pujault, Department of Gard.‡

\* BOYER DE FONSCOLOMBE: *Description du genre Phylloxera*. (Ann. Soc. Entom. de France, 1834.)

† ASA FITCH: *Patent Office Report*, 1854, p. 79; and *Agricultural Society of New York*, 1854, p. 862.

‡ “It was about this time, between 1858 and 1862, by a singular coincidence, that importations of American roots were made at different points of Europe—Bordeaux, England, Ireland, Alsace, Germany, Portugal. It was in 1863 that the first signs began to be visible in the graperies of the United Kingdom, and then in an uncertain manner at Pujault (Gard); more clearly in Vaucluse and Bouches-du-Rhone; and still later in Germany and in Austria (at Klosterneuberg), where American vines were secured at different times.” [From PLANCHON: *La Question Phylloxérique en 1876*. (*Revue des Deux Mondes*, January 15, 1877.)]

We learn the following from a note by M. de Penaurun, of Villeneuve-Avignon, published July 7, 1868, in the Bulletin de la Société d'Agriculture de Vaucluse. To be brief, many of the provençal agriculturists, finding their vines dying from some inexplicable cause, and having found on the dead roots traces of *mycelium*—such as there are nearly always on the dead woody tissues of the root buried under ground—attributed the disease to *pourridié* or *blanquet*, a cryptogamic malady of the vine, which is usually found in locations where the subsoil is impermeable. However, this new “*pourridié*” appeared, against all rules, among the youngest and most vigorous vines on the hillsides. Then the Société d'Agriculture de Vaucluse and M. Gauthier, the Mayor of Saint-Remy, solicited the advice and assistance of the Société Central d'Agriculture de l'Herault.

A commission, consisting of Messrs. G. Bazille, J. E. Planchon, and F. Sahut, were duly appointed, and on July 15, 1868, they met on the grounds of the Chateau de Lagoy, near Saint-Remy. They examined with much care the roots of the affected vines, and speedily the discovery was made by M. Sahut, of a confused mass of little yellow insects, which M. Planchon recognized with the glass as connected with the *cochenilles* and the *pucerons*. Returning to Montpellier, and aided by M. Donnadieu, zoölogical preparator for the Academy of Sciences, M. Planchon examined the insects with the microscope, and the provisional name of the insect was decided upon as *Rhizaphis vastatrix*. A note was shortly afterward drawn up and sent to the Institute.\*

The first publication was made, however, in the report to the Société d'Agriculture de l'Herault, published by the *Messenger du Midi* of July 22, 1868, and signed by the above three delegates.

The cause of the disease is thus recalled: “After two days of investigations,” says M. Planchon,† “we found the insects in a hundred places, in all of which the vines were suffering. At that moment one cardinal fact was established: the disease is caused by an almost invisible insect, hidden under the ground, multiplying by myriads, and exhausting the roots of the most vigorous vines. But the insect. Whence came it? How is it to be described? To what is it most nearly allied? These questions were not easily to be determined at once; all the forms of the insect's life could not be found at once.

“Having at that time seen only the insects living below ground, and without wings, I sought persistently for the winged form, which I supposed must exist. This form did exist, and having discovered the nymph I saw it produce on August 28, 1868, an elegant little winged insect, with four transparent wings, spread flatly.”

The insect submitted by Messrs. Planchon and Lichtenstein to the noted hemipterist, M. Signoret, was assigned by him to the order of *Phylloxera*,‡ created by Boyer de Fonscolombe for the *Phylloxera quercus*.

“Thus,” continues M. Planchon, “my *Rhizaphis* was assigned to its true order. It now remained to identify the insects with the American variety. The first step in this direction was the result of a happy accident. On the 11th of July, 1869, while traveling with a commission from the Société des Agriculteurs of France, I discovered at Sorgues

\* J. E. PLANCHON, G. BAZILLE, and F. SAHUT: *Comptes rendus, Acad. des Sciences*, meeting of August 3, 1868, page 333.

† J. E. PLANCHON: *Le Phylloxera en Europe et en Amerique*. (*Revue des Deux Mondes*, February 1, 1874.)

‡ SIGNORET: *Bulletin Soc. Entom. de France*, September 23, 1868.

(Vaucluse), on two vines of the vine called the Tinto, many galls like those of the American *Pemphigus*."

According to Dr. Plumeau,\* it was M. Laliman who was first to find the gall insect in France, on American vines. We mention this as a matter of history; but in fact it is a matter of little importance to science and to viticulture whether the gall form was found first at Bordeaux or Sorgues, and in both cases it can be said that the discovery was nearly simultaneous. In the spring of 1869, J. Lichtenstein was the first to advance the theory that the root phylloxera was a subterranean form of the *Pemphigus vitifolii* of Asa Fitch; a simple hypothesis, which was speedily accepted, and of which Planchon, himself, was not slow to accept the responsibility. (*Mess. Agr. du Midi*, September 5, 1869.)

While these studies were being prosecuted by us in France, Westwood had continued his observations in England, having received insects from France and the United States, and in a paper appearing in the Proceedings of the London Entomological Society, February 1, 1869, he identified his *Peritymbia vitisana* of 1867 with the insect called *Pemphigus vitifolii* by Asa Fitch, *Dactylosphæra vitifolii* by Schimer, and *Phylloxera vastatrix* by Planchon.

In spite of some protests coming from partisans of the priority of nomenclature, this last name has been adopted by science for three reasons: First, as the name of priority, the order of *Phylloxera* dating from 1834, it cannot be changed; second, the qualification *vastatrix* (devastator) is better than *vitifolii* or *vitisana*, as conveying the idea of an insect destroyer *par excellence*; third, the name has the advantage of general usage, and the recognition of the press of the entire world.

In 1870, Professor Riley, who then lived at St. Louis, Mo., established: First, the identity of the gall insects found in Europe with those of America; second, the identity of the gall and root types of the insect.†

These observations, confirmed in 1871, at the time of a visit of the American savant to France, are no longer debated or questioned.

As the knowledge was in 1870, so was it also in 1873. During these three years, in spite of the attentive study of a large number of naturalists, the cycle of metamorphoses was not completely known. The sexual form, which exists in all aphidians and lays the winter egg, could not be wanting in the phylloxera. At first it was thought that the winged insect was the sexual form.‡

The error was excusable, the males of certain pucerons and of the *Phylloxera quercus* being ordinarily provided with wings; then it was noticed that with the *Phylloxera vastatrix* all the winged insects laid eggs, and laid without any coupling. \* \* \* The sexual form—so remarkable in the fact that it does not have a sucking apparatus—was then discovered on the phylloxera of the oak by M. Balbiani,§ and then, following this, that of the vine by Max Cornu,|| who, nevertheless, observed only two females. This study having been continued in 1874 at Mont-

\* DR. PLUMEAU: *Association Française pour l'Avancement des Sciences*, 1872, session at Bordeaux, page 636.

† American Vines, by Bush & Meissner. Translated from English by L. Bazille, and revised and annotated by J. E. Planchon, 1876; 2d edition, 1885.

‡ DR. SCHIMER: Proceedings of the Academy of Natural Sciences of Philadelphia, November 1, 1867, pages 2 and 11; also, SIGNORET: *Le Phylloxera Vastatrix*. (*Ann. Soc. Entom. de France*, 1869, page 549.)

§ BALBIANI: *Comptes rendus de l'Académie des Sciences*, October 20, 1873, page 884.

|| MAX CORNU: *Comptes rendus*, November 3, 1873, page 1015.



pellier by M. Balbiani,\* male and female insects were just seen to leave the shell of the eggs laid in captivity by the winged insects. In the month of August, 1875, M. Boiteau discovered the place where the winged insect ordinarily lays its eggs.†

It now remained to study the sexual forms with a certain number of individuals normally born; to observe their coupling, and in like manner their laying, and finally to secure the winter eggs. In accordance with observations made upon the species peculiar to the oak, these must be hidden in the bark of the stock. That is what Balbiani succeeded in discovering in the month of September of the same year. Commodiously installed at Libourne, with M. Boiteau, in a laboratory well provided with microscopes—a laboratory which I know well from having investigated the question of the winter egg in 1878—M. Balbiani brought to a good conclusion his delicate operations, and closed the gap in the cycle of the metamorphoses of the *Phylloxera vastatrix*.‡

At the same time was published by M. Balbiani the results of his beautiful observations on the gradual degeneracy of the ovaries of the phylloxera—a degeneracy which, accentuating itself from generation to generation, can result in the sterility of the insects, but which ordinarily terminates in the production of the winged insect (and then the sexual insect) which lays its single egg. The fecundation of this egg by the coupling of the sexual insects being, according to the author, the point of departure of a new fecundity, he arrives at the conclusion that the complete extinction of a colony of insects might be accomplished by the destruction of the winter eggs each year by a treatment of insecticides.

From 1875 to 1881 his studies were continued. In a series of papers to the Institute, sent by M. Boiteau,§ the place of the laying of eggs by the sexual insect was determined, the phylloxera were observed leaving the winter egg, and their settling first on the leaves and then on the roots was demonstrated by experience.

Not one salient fact has come to weaken the work of M. Balbiani. Winter eggs have been found numerously at Libourne by M. Boiteau; but whatever confidence which one has in the observations of the learned Professor of the College of France, science has not yet completely adopted his conclusions. M. Lichtenstein and ourselves have observed in Languedoc, under favorable circumstances, the laying of the winged insects and the hatching of the sexual; the winter egg has been obtained by us in many cases in our laboratory at l'Ecole de Agriculture of Montpellier,|| but the observation on vines in open air of the laying of the sexual insect is wanting in the Gironde. In spite of the conscientious observations of Messrs. Planchon, Lichtenstein, and Mares; in spite of my own work since 1877 at Montpellier, after having been many times to Bordeaux and Libourne to study the question, with M. Boiteau as guide; in spite of a special mission in Herault intrusted to M. Boiteau in 1878 by the Minister of Agriculture; the fecund egg continued to baffle all the seekers. Is it the same in dry countries as in wet ones? Does it ever

\* BALBIANI: *Comptes rendus*, August 31 and December 14, 1874.

† BOITEAU: *Interet public de Libourne*, numbers of September 2, 9, and 16, 1875; and also, BALBIANI: *Comptes rendus*, October 4, 1875.

‡ BALBIANI: *Comptes rendus*, October 4, 1875, and July 17, 1876.

§ BOITEAU: *Comptes rendus de l'Academie des Sciences*, May 10, June 5, July 8, August 5, and November 6, 1876.

|| VALERY MAYET: *Comptes rendus*, November 2, 1880.

hatch before winter? This last question is found in most writings on phylloxera,\* and when Mr. Graëlls, Professor of Comparative Anatomy at the University of Madrid, announced, in September, 1878, at the Viticultural Congress at Montpellier, that he had seen on August 8th, at Malaga, winter eggs laid in July hatch on the former date, this question appeared to be decided in the affirmative.† “M. Graëlls,” said M. Planchon, “is a savant whose eye and judgment are above suspicion when he makes a statement as to what he has seen.”‡

No one could doubt the good faith of M. Graëlls, and our personal and friendly relations with the Spanish savant are such that we can affirm his faith in the premises; but in observations as delicate as these are, in which it is necessary to precede the investigations by long and minute work with the glass, and afterward isolate by microscopic examination all the invisible corpuscles which to the naked eye resemble an egg, has he done all this with requisite care?

“In order to make my investigations,” writes M. Graëlls (*Journal de l'Agriculture*, 1880, page 106), “I brought from Malaga to Madrid the roots of phylloxerated vines. Losing hope of finding the winter egg with the glass, in the manner of M. Boiteau, it occurred to me to shake the dried roots over a white paper on a table. In examining with a glass, the detritus obtained, I found some eggs of the sexual insect, easily recognizable by their singular character. Placed where they could be observed, they hatched, some in about three or four hours; others somewhat later.”

The studies in Languedoc were then considered useless by certain naturalists. Lichtenstein—not to mention one better known—abandoned them completely, though he was likely to bring them to a satisfactory end. “You lost your time,” we said to him. “Seek and you will find,” we wrote, on the contrary, to M. Balbiani. Confident in the work of the savant who was the first to find the fecund egg in the Gironde; convinced ourselves that as far as France was concerned the experience at Madrid was in nowise conclusive, we continued the search, and on March 16, 1881, we found the winter egg at Montpellier,§ on the property of Viviers, with M. Pagezy. We found them in sufficient quantity to satisfy all observers, Lichtenstein the first of all, who found them himself on our advice as to how to work.

On this occasion we received a visit from M. Henneguy, delegate of the Academy and assistant as preparer for M. Balbiani of the College of France, and who was at that time engaged with M. Mares on the property of la Paille at Montpellier, in experiments to ascertain if the fecund egg could be completely destroyed by the use of insecticide lime washes.¶ The point to which we wish to draw special attention is that we wish to guide one surely in the study of the winter egg; and that the gall insects are observed annually at the same point; and that by the removal of the gall insects, covering a period of years, all the world can judge the efficacy of the process. At the end of 1886 the lime wash had not been applied; the galls reappeared in 1887. At the end of 1887 the lime wash

\* PLANCHON: *La question phylloxérique en 1876*. (*Revue des Deux Mondes*, January 15, 1877, page 30.)

† See on this subject—LICHTENSTEIN: *Le Phylloxera en Espagne* (*Journal la Vigne Americaine*, 1879, page 208; also, GRAËLLS: *L'oeuf d'hiver du Phylloxera* (*Journal de l'Agriculture*, 1880, pages 27 and 102); also PLANCHON, *Vigne Americaine*, 1880, page 70.

‡ PLANCHON: *Vigne Americaine*, 1880, page 120.

§ VALÉRY MAYET: *Comptes rendus, Académie des Sciences*, March 28, 1881.

¶ BALBIANI: *Comptes rendus*, April 10, 1882, and October 20, 1884.

was renewed; there were no galls in 1888, except on the marked vines.

M. Graëlls, nevertheless, has not yet surrendered, and in his latest work on the Aphidians (*Cuestiones biológico-ontogenicas y fisiologicas de los afidios*, Madrid, 1887), he persists in regarding his experiments as conclusive. However, we will consider our own observations as conclusive—at least as concerns France and the greater portion of Europe; the subject of summer hatching is not supported, however, except in Spain.\*

We will say nothing of the conditions in Andalusia, and still less of those in tropical countries. It is certain, however, at Panama, for example, where M. Collot, Professor at Dijon, has proved the existence of the phylloxera on the leaves of the *Vitis caribæa*—leaves which were carried to M. Planchon—the eggs do not act the same as those found in Europe. The silkworm of the mulberry offers us a phenomenon going to support this hypothesis. Its eggs, according to M. Duclaux, do not hatch normally in temperate countries, unless they have been submitted to the influence of cold; that is to say, after winter or after they have been submitted for one or two months to artificial cold. As against this, in warm countries, India, for example, the eggs hatch without being ever submitted to the action of cold, and produce many generations in a year. The silkworm of multiple generations in a year is rare in France, is more frequent in Italy and Spain, and is the rule in tropical countries. In India the hatching is in February, June, and October.

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## CHAPTER II.

### PROGRESS OF THE PEST.

Originating in America, or more properly speaking, that part of the United States situated east of the Rocky Mountains, the phylloxera was strongly established toward 1869 in the southeast and southwest of France. The two points of introduction—two collections of American vines, one at Roquemaure (Gard) and at Floirac, in the immediate neighborhood of Bordeaux—have been determined and formed two infected spots, from which the disease radiated rapidly with a tendency to converge, one toward the other. In 1870, the departments of Gard, Vaucluse, Bouches-du-Rhone, and Var were completely invaded, and Herault was attacked in one of its richest vineyard districts, the plain of Lunel. From 1871 to 1876 nearly all the vines about Montpellier were destroyed, and those of Beziers were touched. At the same time, toward the north, the enemy having ruined the celebrated vineyards on the hillsides of the Rhone, beset Lyons and numerous points, pushing to Beaujolais. In 1878, the invasion reached the departments of Alpes-

\* In France there has lately been evolved a theory, which we will call a "mixed theory," which, however, has as yet only been admitted by its author, M. Donnadien, of whom we have already spoken, and who was the first to study the phylloxera with the microscope, with M. Planchon. He speaks, in a paper to the Institute (*Comptes rendus*, May 9, 1887), of fecund eggs which go through the winter, and of others which are hatched in the autumn. These two varieties of eggs, he claims, are laid by two different forms of phylloxera. We are awaiting a later work announced by the author, a work which is expected to clear up certain points in his observations, and which we are not yet able to seize with precision.



Maritimes, Aude, Pyrenees-Orientales, Aveyron, Puy-de-Dome, Ain-Saône-et-Loire, Cote d'Or, and the island of Corsica.

In the west, the progress of the pest, though somewhat slow at first, was very rapid after 1872. The Medoc and the Sauternes, the *graves*, mixed with sand, offered a certain resistance to invasion; but the *palus*, "Entre-deux-mers," Lot-et-Garonne and Dordogne, with their more argillaceous soils, and above all the Charentes, with their light, chalky soils, shallow, and easily cracking in summer, were soon seriously attacked, and about 1879 completely ruined. In 1880, on the official chart, published every year by the Minister of Agriculture (and on which the attacked districts were tinted light or dark, according to the severity of the attack), the two great sources of the disease were shown as having joined, going across Lot, Gers, Tarn-et-Garonne, Haut Garonne, and Tarn. In the north the disease reached Loire by Indre, Loir-et-Cher, and Loiret. In the last charts published, the department of Seine-et-Marne is given as attacked; and to the great dismay of the viticulturists in the immediate vicinity of Paris, the phylloxera has been discovered on the vines on the lattices of the National Agricultural School of Grignon (Seine-et-Oise). In the basin of the Rhone all departments in which vine growing prevails have been invaded. In Corsica, the disease has been found in the arondissements of Ajaccio, Corte, and Bastia. At the hour we write, more than a million hectares have been attacked in France, and among all our great vineyard-growing districts, the Champagne district alone is yet untouched, though it is menaced strongly by the infected points in Seine-et-Marne.\*

In Algeria, in spite of the fact that the law of 1881 ordered, as in Switzerland, the complete extinction of attacked spots, the pest has appeared in Sidi-bel-Abbes, Tremcen, Oran, Philippeville, La Calle, Souk-Arras, and measures taken for its extinction.

In foreign countries, as well as in France, it was the American vines which, in the beginning, introduced the phylloxera. In the valley of the Douro, in Portugal, many of the vines had died before the insect was discovered. Its presence, proved in 1870, appears to have followed an importation of American vines in 1863. In Spain, the two great points of infection—Malaga in the south, known since 1877, and Gironde in the north—appear, however, to have originated with some vines from France. The first point of attack in Switzerland, noted in 1874 with M. de Rothschild at Pregny, came from infested vines received from the English graperies, and the phylloxera at Neuchâtel came from the German nurseries at Annaberg; to-day, in spite of the energetic enforcement of the law referred to above, the disease has reached the vineyards of the canton of Vaud, and at one point in the canton of Zurich.

In Germany the numerous affected spots in the valley of the Rhine have had their origin in the nurseries and collections of vines of Annaberg, Erfurt, Bolweiler, Plantreres, etc.

Austria and Hungary must have received the pest in 1868 with some vines imported from the United States, the first points of invasion being Klosterneuburg, Pantchowag, and Fünfkirchen.

\* Since M. Mayet wrote, the Champagne district has been invaded, and, although strenuous efforts have been made to dislodge the pest, it is likely to retain its foothold and spread, on account of the disinclination of the smaller vineyard owners to join in measures to stamp it out, until too late.

The discovery of phylloxera in Italy (at Valmandrera, province of Como, and Agrate, province of Milan) dates from 1879. In 1880 new spots were discovered at Port Maurice, Riesi, and Messina, and in 1882 in the neighborhood of Girgenti and Catanina.

Crimea and the Caucasus, the two leading vineyard sections of Russia, have been infected since 1880, and Bessarabia since 1886, from the introduction of roots coming from Erfurt, in Germany.

In the Danubian provinces of Roumania many points of attack have been reported in the vicinity of Jassy and Galatz (Moldavia).

In Turkey in Europe and Turkey in Asia the introduction of the disease dates from 1885; but it has already become widely spread.

Greece, alone, at this time, appears to have had immunity; but it will not be long, no doubt, before that country is invaded.

Outside of Europe, the vines of Madeira are destroyed, and those of Cape Colony are strongly touched. Australia, which has frequent communication with the United States, has had phylloxera since 1875. Lastly, California, the only section of the United States in which the European vine succeeds, is seriously affected. Many of the vineyards are destroyed and the Mission vines have suffered and the vineyardists have begun to reconstitute their vineyards with American stock.

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### CHAPTER III.

#### LOSSES OCCASIONED IN FRANCE BY THE PHYLLOXERA.

Before describing the insect, we will give here some particulars as to the losses which have followed its introduction into our country. As far as concerns countries outside of France, we do not have the documents at hand; but as regards France, an article published in 1888 by M. Lalande, Deputy from Gironde, appears to present the situation in its true light, and we deem it useful to reproduce his remarks here.

"Few persons," says M. Lalande, "have formed any sufficient idea of the losses sustained by France in consequence of the ravages of the phylloxera. The following statistics, based on the report of the Director of Agriculture to the *Commission Supérieure du Phylloxera* for the year 1884, contain some elements from which these losses can be appreciated.

"According to this report the area of vines in France destroyed by phylloxera up to the end of 1884 was upward of 1,000,000 hectares, passing this estimate a little. But this is not all. Aside from vineyards entirely destroyed there were others affected, but still living. This area is estimated at 664,511 hectares.

"It is very probable that it is under the truth if we estimate this area of affected vines as the equivalent of 200,000 hectares of vineyards entirely destroyed.

"The actual loss is therefore 1,200,000 hectares of vines actually destroyed—that is to say, half of the vineyards of France.

"From these statistics what is the actual money loss of these 1,200,000 hectares? Here we must make an observation which appears to us of very great importance. The value of the destroyed vines is generally computed according to their actual selling price; but viewing this from the point of their value to the nation, this is under the actual value.

"As a matter of fact, the actual selling value is based on the annual net revenue, but the value of vineyards from the view of the nation is much above this. The value is based on the gross revenue, which can be resolved into two parts: First, that which is necessary to pay salaries and different costs of cultivation; second, the excess, which constitutes the net revenues.

"It is evident, considering the common weal, that these two elements can be confounded. However, all things considered, we believe that the actual value of the vineyards destroyed in France is estimated at an average of 6,000 francs per hectare."

(But if, after the considerations above stated, one wishes to take a basis from which to calculate the gross revenue, the value of the vineyards must be estimated as considerably above 6,000 francs per hectare.)

"In truth, after the vineyards are gone, there still remains the value of the bare soil; but in France this value is generally very small, most of the vineyards being planted on land but little suited to other purposes.

"Everything considered, and exaggerating nothing, I will adopt as a basis of calculation the estimate of 6,000 francs per hectare given above, and we thus reach the sum of 7,200,000,000 francs as representing the actual money loss sustained by France from vines destroyed by the phylloxera.

"Nor is this all. To this loss of actual capital should be added the loss of salaries and other revenue sustained in consequence of the loss of the vines. This is difficult to calculate. But we will be under the truth if we take as a basis for an estimate the value of the wines and dried grapes that France has imported—the latter to be made into wine—since the destruction of our vineyards. These importations, as will be seen, are upwards of three milliards of francs.

*Importation into France of Vins Ordinaires and Dried Grapes from 1875 to 1887.*

Year.	Vins Ordinaires.	Dried Grapes.
	Fr.	Fr.
1875.....	8,351,741	5,755,614
1876.....	18,468,811	5,447,207
1877.....	22,593,989	8,649,482
1878.....	50,204,145	14,829,096
1879.....	107,479,899	40,807,043
1880.....	297,917,248	62,631,970
1881.....	346,516,425	37,364,289
1882.....	295,207,947	31,903,088
1883.....	360,000,000	39,000,000
1884.....	319,664,326	49,644,909
1885.....	361,476,079	95,350,824
1886.....	489,985,194	88,422,465
1887.....	545,000,000	98,000,000
Totals.....	3,222,866,504	577,805,984

*Résumé.*

	Fr.
Vins ordinaires.....	3,222,866,504
Dried grapes.....	577,805,984
Total.....	3,800,672,488



"We thus arrive at the estimate of upward of 10,000,000,000 francs as the total loss caused by the phylloxera in France in consequence of the phylloxera."

There is no question that in the foregoing article, written by one of the leading merchants of Bordeaux, gives a true estimate of the *passive* loss sustained by France, if I may so express myself; but in the *actual* loss, which includes the cost of reconstituting the vineyards, the estimate is too low for the burden which our national economic situation now sustains and will sustain for a long time.

On consulting the statistics published by the Director-General of Agriculture in 1888, we find that the vineyards successfully defended from the phylloxera or re-constituted are no greater than 268,207 hectares; place it at 300,000 hectares, certain vineyards in sandy soils not having been included in the above statistics. What, in fact, is this to the 1,200,000 hectares destroyed? Scarcely a quarter, from which can be deduced the expenses for re-constitution.

We say, then, with M. Lalande, that "far from being astonished at the gravity of the losses sustained by the country, we should rather be surprised that they are not greater, following such a disaster."

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## CHAPTER IV.

### DESCRIPTION AND BIOLOGY.

The description of the *Phylloxera vastatrix*, and of its habits, can be found in numerous works, good or bad, on the details of which we will not enter at this place; we will merely say that aside from certain documents drawn in the *Comptes rendus* of the Institute, and some other works, these different books are all more or less written from two important works—those of Max Cornu and M. Balbiani. The first, which appeared in 1878 (Paris, *Imprimerie Nationale*), entitled *Etude sur le Phylloxera Vastatrix*, contains principally the detailed history of the first three forms of the insect known. The second, published in 1884 (Paris, *Imprimerie Nationale*), entitled *Le Phylloxera du Chêne et le Phylloxera de la Vigne*, gives in detail the particulars of the sexual form and its single egg—the winter egg. These two works together form a masterpiece, in fact what might be called a classic. All authors have drawn upon these works. The remarkable drawings of M. Cornu, for example, have been reproduced alike in France and in foreign countries; we will ourselves draw upon them frequently, referring our readers to these two sources for numerous details which cannot be entered into in a work necessarily condensed as this one is.

The phylloxera appears normally in four different forms, one succeeding the other, always in the same order and always with a decreasing number of eggs.\*

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\*This diminution of fecundity is observed not only in the evolution cycle, but in the many generations which succeed each other in the gall and root forms of the insect, so that the insect would become extinct of itself after some generations were it not for the regeneration of the race by the fecund egg. Such is the theory, proved by observation, which has been developed for a long time by M. Balbiani in the *Comptes rendus* (October 4th, and July 17, 1876), as well as in his book on page 3. From this one can conceive of the importance for destroying the winter egg. Certain naturalists, Lichtenstein among others, have opposed this idea; but a trifle carried away by polemical ardor, we believe

These four forms are—

The Gall, or form of multiplication.

The Root, or form of devastation.

The Winged, or form of colonization and extension.

The Sexual, or form of regeneration.

The gall insect, in the first generation at least, lays five or six hundred eggs; it is the insect that multiplies the race. The root insect lays a hundred or so eggs, but it is *par excellence* the destructive form of the insect and the one which kills the vine. The winged insect is the one which goes afar to spread new colonies, and lays from one to eight eggs; and the sexual insect, from which the entire race is regenerated, lays its single fecund egg after coupling.

The first three forms reproduce themselves without coupling; that is, by parthenogenesis. The sexual form consists of males and females. The unique egg which they produce was called the winter egg by its discoverer, M. Balbiani. It constitutes the point of departure and the point of arrival of the evolutive cycle of the phylloxera. It is with its description that we commence.

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## CHAPTER V.

### WINTER EGG.

This egg is laid by the sexual female under the most adherent bark of the vine, principally that of the wood two years old, and as indicated by Boiteau, preferably when the bark is a little dehiscent at the section of the last pruning. It was there that we usually found it at Montpellier. (See *Comptes rendus*, March 28, 1891.) We have also found it on the wood three years old. M. Balbiani and M. Henneguy have also observed it, but less frequently, on wood of all ages. The egg is attached to the wood by a little pedicel, and is placed between two salient fibers, sometimes affixed to the wood and sometimes to the bark itself. This pedicel, which has been given as a principal characteristic, is not always visible, but one can mark the fecund egg to a certainty by a little reddish-brown point situated on the side opposite the pedicel, and which is nothing but a micropyle or little opening, through which the spermatozoa have penetrated in order to complete the operation of fecundation. (See on this subject the book of M. Balbiani, plate V, figures 5 and 17.) As these figures concern the phylloxera of the oak and not that of the vine, the phenomenon is the same in the two species. (See also the same work for information concerning the anatomical details of the winter egg and the particulars of its embryonic development.)

The agamous eggs, which do not have to be fecundated, do not have a micropyle. The winter egg is from 0.27 to 0.30 of a millimeter long and from 0.10 to 0.12 of a millimeter in width; that is to say, is just about invisible to the naked eye. It is cylindrical and not ellipsoidal, as are the eggs of the agamous forms. Immediately after it is laid it is of a

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their experiments are perhaps wanting in necessary care. More important are the latest observations of M. Boiteau (*Comptes rendus*, July 18, 1887), who for six years cultivated the growth of the root form, and who, after reaching the twenty-fifth generation, found individuals very prolific.

very brilliant pale yellow. On the following days the color deepens and brown spots appear upon it, appearing as a reticulated design in relief, which are, according to M. Balbiani, the imprint of epithelial cellules lining the ovary of the mother. Then the color becomes dark olive green, less brilliant, which holds throughout the winter, and which makes a search for the egg very difficult. At the end of February or in the first days of March it turns an amber yellow, glossy and very brilliant, and at this period the egg is very easy to be seen. Following this development the dimensions of the egg become greater, that is, 0.35 to 0.37 of a millimeter in length and 0.16 of a millimeter in breadth.

In Bordelais, according to M. Boiteau, the egg hatches in the second fortnight of April. At Paris, M. Balbiani, who was without doubt working in his experimental laboratory, has seen the young on the 9th on wood brought from Libourne by M. Boiteau. At Montpellier, the first hatching was observed by us between the 25th and 30th of March in the open air, while in experimental work the eggs appear to be hatched by the 15th of April. These dates are certainly open to modification, according to the condition of the weather. Some days before the hatching the eyes can be seen through the different envelopes which constitute the shell of the egg, in the form of two red spots situated at the end, and at this same end, equally distant from the two eyes, can be seen a semi-circular black line, which is nothing else than the special organ which can be seen on the agamous eggs, and which has been compared by M. Cornu to a dentalated crest. This organ is for the purpose of splitting the shell of the egg at the moment of hatching. After the insect has left the shell the shell remains open at its anterior portion. (See Cornu, page 196, plate XVII; figures 5, 6, and 8.) Is the winter egg ever found upon the roots? M. Balbiani (*Comptes rendus*, November 2, 1874) says he has seen it at the same time as the sexual female. Dr. Fatio, of Geneva, believes that he has found the fecund egg on the roots of a vine cultivated in a separate vessel. This latter observation, it seems to us, wants desired accuracy. And further, Dr. Fatio, in his description of this egg, does not mention the little red point of the micropyle, *its infallible characteristic*, and it may be that the phylloxera does not possess its normal condition when the vine is cultivated in a pot or vessel. The case noted by Balbiani is isolated, according to the author himself, who says that everything indicates that this generation is exceptional.

\* \* \* In order to find the fecund egg it may be said at first that it is necessary in order to succeed to acquire the habit of minute investigation with the glass. It may be said that the month of March is the most favorable for making any search for it, as the color of the egg at this period is much brighter than during the winter.

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## CHAPTER VI.

### THE GALL INSECT.

From the winter egg the gall phylloxera is produced. This is the experience of all observers up to the present time, and we will refer all readers of this subject to the observations of M. Boiteau. (*Comptes rendus*, April 27, May 10, June 3, and July 8, 1876.) Some observers



have ineffectually attempted to say that the root phylloxera is produced directly from the winter egg; but as a matter of fact the insect produced by this egg goes first to the leaves. This young phylloxera chooses always the most tender leaf; that is to say, the one last unfolded. Sometimes it takes the young shoots as they appear, and places its sucking apparatus on the upper side of the limb. (See Baliani, page 29.) In about twenty-four hours a depression is formed and the gall commences to appear on the opposite face. The depression on the upper face becomes deeper and deeper, and the gall dilates itself from the interior into a roundish cellule. The upper orifice on this cavity is in the form of a crack (plate I, figure 1), furnished with stiff hairs, which cross each other and disposed in such manner that the passage closed to entrance is open to exit. The interior of this cellule is round and glossy. The insect which is inclosed absorbs easily the juice of the parenchyme in which it reposes. Exteriorly, that is to say, on the leaf, the excrescence is unequal, warty in appearance, covered with longer and more irregular hairs than those of the leaf. The structure of the gall, thickened by some millimeters, is due to the hypertrophy of the cellules of the limb; it is poor somewhat in chlorophyl, and is often reddish in color. "One can ask," says Cornu, "what portion of the thickening of the normal leaf is due to this new formation? Is it due to the production composed of prismatic cellules perpendicularly arranged to the plane of the leaf, or is it due, on the contrary, to the hypertrophy of the parenchyme of the underside of the leaf?" The disposition of the vascular fascicles of the leaf permit us to answer this question. It shows that the portion above and below is hypertrophied.

The galls are found in the tissue which is being developed. The leaf is already started when the phylloxera is born, but not being more than a centimeter in diameter is in the best condition for the growth of the galls. The insect never fixes itself on developed leaves. At the place where it begins to suck, the cellules, in consequence of the constant absorption of the juice, are stopped in their development, and there results a modification of other cellules of the leaf, not attached and situated on the other face of the leaf. These cellules grow to various lengths, and by a very simple mechanism the insect ends by being inclosed in the cavity. The galls are not only found on the leaves but sometimes on petioles and even on the green stems which are growing at the extremity of the vine.

"In this case the galls take on," says M. Cornu, page 32, "the form of a wart, hollowed at its apex and having an elongated opening. There is sometimes a sort of a crack with parallel borders somewhat swelled and raised up. This crack may be more or less gaping; it is always furnished with numerous hairs. One can see in the interior of the cavity the phylloxera surrounded by eggs. The number of eggs is sometimes greater than those which could be contained in the little cavity where the insect lies. Those produced last crowd the older ones to the exterior of the border of the cavity. The galls take on larger size as the leaf becomes developed. They attain the size of 4 to 5 millimeters in thickness, and the interior cavity sometimes measures 3 millimeters in diameter."

Often at the time of the vintage certain of these galls, more developed than the others, contain two, three, or even four gall insects. They are generally laying insects, which in place of emigrating are fixed at the

place where they were born, utilizing in common the gall formed by the mother. The body of the mother insect is generally found surrounded by the brown shells of its eggs. When the body of the mother is not there many of the young will be found established side by side on the leaf and the galls may be joined together. If the leaf does not grow the galls are abandoned. If no longer submitted to the attack of the insect, the excrescence takes on a special form, elongating to a sort of petiole, which tends to lengthen the blade of the leaf.

The phylloxera which issues directly from the winter egg has a peculiar aspect, and unites in large degree the general characteristics of the gall form. It is on this that we will give a description of the gall.

"It resembles," says M. Balbiani, "its mother; but it differs from it when young by being of smaller size and having its digestive apparatus well developed; when of adult age it has a large number of oviparous cavities (45 to 50). It is always easy to distinguish it from the young of the ordinary gall insects by the last article of the antennæ, which is fusiform. Another peculiarity of its organism is in having its sucking apparatus lodged in a deep depression of the ventral side of the body. Its average size is 0.40 of a millimeter in length and 0.16 in breadth. The two lateral hairs of the last article of the antennæ are placed one behind the other; the terminal hairs are a little longer than those of its mother, and the olfactory orifice is small and oval. In the first generation (the insects produced by the first gall insect) the third article is still fusiform; but the two lateral hairs are closer to each other, the terminal hairs longer, and the olfactory orifice is elongated longitudinally. In the following generation (the grandchildren of the first insect) the third article is enlarged, and the last lateral hair is placed to almost the same level as the other one. Afterward the third article has all the characteristics of the root form." \* \* \*

We will add that the gall form (Figure 8 is apterous and always agamous; that the body is rounded, attenuated at the back; that it is yellowish, bordering on green in color; and that the back does not carry the tubercles so characteristic of the root form. It is larger than the root form—a millimeter and a quarter long by a millimeter broad—the root form not being larger than a millimeter long. On account of its great ovarian development the gall insect is thick and round. The eyes are rudimentary, formed of three ocelles, reddish in color, placed in shape of a triangle and back of the antennæ. The legs, the antennæ, and the head (sucking apparatus) are relatively short. The legs are made up of the thigh, the tibia, and the tarsi; the latter, after the second moulting, being formed of a single article, terminated by a double hook. The antennæ—the organs of feeling and smell—are composed of three articles, the first two short and thick, the third long.

The sucking apparatus is composed of four stylets. \* \* \* When the insect wishes to suck, the two exterior stylets attack the parenchyme perpendicularly to the plane of the blade, and the juice goes into the digestive apparatus by capillary action.

The stigmata, or breathing orifices, are very difficult to see, and number six pairs, placed laterally under the ventral part—one pair under the pro-sternum, one pair under the meta-sternum, and four much smaller pairs on the first four abdominal segments.



Fig. 8.  
Gall Form.

After arriving to a perfect state—which requires about fifteen days, the insect undergoes three moultings, the latter two of which may represent the transformation from the larva to the nymph, and the nymph to the perfect insect.\*

Always three shells can be found within the gall.

Once fixed the gall insect does not move, but remains immobile at the bottom of its gall, and as soon as the third moulting is over it begins to lay. In the period of three weeks, or thereabouts, five or six hundred eggs are laid in the gall and accumulate about the laying insect; but this number of eggs can never be found at one time, for after eight days have passed the hatching begins and the young begin to leave, this being when the laying is scarcely half done. The ability of the young to move is great. They move, according to M. Boiteau (*Comptes rendus*, June 5, 1876), 13 to 14 millimeters a minute, or about 80 centimeters an hour. They start for the young leaves at the extremity of the canes. In the generations which follow the first—up to October sometimes as many as seven can be counted—the reproductive faculty diminishes progressively. While with the first generation five or six hundred eggs are laid, the last generation will not produce more than one or two hundred, the number decreasing successively with every generation from the first. This is conformable with the theory of the degeneracy of the ovaries of which we have spoken.

In October, or later, in November, that is to say, with the first frost and cold, the laying insects die with the leaf, and all the young leave the galls and go to the roots, where they hibernate all winter without eating. In the spring they attack the rootlets, and are then the veritable root insect. Added to this, very frequently, after the third generation of the gall form, a great number of the insects go to the roots and become the true root insects in the first year of the cycle of life.†

The insect in going from the gall to the root follows ordinarily the cane and the stump; sometimes, also it falls from the leaf.

The eggs are ellipsoidal, about 0.30 of a millimeter in length; at first a bright yellow in color, but turning reddish-brown and brown as the embryo is developed.‡

\* Certain authors consider all the agamous forms of phylloxera as larva (even the winged form), and only give the name of insect to the sexual form, as this alone produces an egg normally fecund. We do not adopt this manner of conception of the cycle of the phylloxera—not that the idea of larva laying eggs would interfere, however, for there are examples of this, but we would hesitate to say that a winged insect was in a larval state. Lichtenstein, however, has admitted this theory and has gone further. He compares the products of agamous insects to the bulbules and to the rhizomes of various plants, establishing an absolute parallel between the Aphidia and certain plants. For him the parthenogenesis of the agamous forms is nothing but a simple budding, while the fecund egg represents the grain or germination.

† The complete cycle of the insect, which ordinarily requires two years and more, can be accomplished in a year. Many experiments have proved this. M. Balbiani (page 20) gives an instance in an experimental bottle where the winged insects have appeared in the month of August from roots to which the gall insects had gone two months previously. M. Boiteau (*Comptes rendus*, November 6, 1876) says that gall insects placed in an experimental tube fixed themselves on the roots, and from their descendants winged insects came in the beginning of September. Other observers, as Schimer and Knyasset, having found the winged insect in the galls, have come to the conclusion that the complete cycle of the phylloxera can be effected entirely above ground; otherwise said, that the root form of the insect can be skipped in the cycle. This theory lacks proper proof. M. Champin, in Drome, has observed winged insects in the galls. We have ourselves seen the nymphs go upon the stumps to metamorphose into the winged insect, and it can easily be supposed that some might accidentally reach the galls and be transformed there. We can say, therefore, with M. Balbiani, that the transformation of the gall into the winged insects is yet to be proved.

‡ See on the Evolution of the Egg, Cornu, page 195.



As we have already noted with the winter egg, it is easy, shortly before the hatching, to see the two eyes as well as the line which M. Cornu has called the "dentalated crest," and which is destined to split the different coverings of the egg. This crest also separates the membrane immediately enveloping the embryo. "If, after hatching," says M. Cornu, "one secures this membrane, he can note that it is brown and is split by the anterior part and exactly according to the direction of the crest."

The galls and gall insects which we have described are best observed on certain wild American vines, such as the *Riparia*, *Clinton*, *Solonis*, and *Taylor*; that is to say, on the different varieties of the *Vitis riparia*. On these vines the phylloxera probably first existed, as they seem best adapted to the mode of life of the insect. On these varieties the insect appears to pass through its four forms most readily and without the vine appearing to suffer. The varieties of the *Vitis æstivalis*—*Jacquez*, *Herbemont*, *Cunningham*, etc.—show a far less number of galls on the leaves; their roots, frequently infested with the root insect when young, appear at the age of four or five years to throw off most of the insects. Not having defended themselves so vigorously against the insect as the *Riparia*, there are not produced rootlets replacing the old ones. With the *Vitis labrusca* and its derivatives, the *Concord*, *Isabella*, etc., very few galls appear, and their root resistance is comparatively feeble. Even in America these varieties in the end succumb; the vine is badly adapted to resist, and the *Vitis labrusca* is certainly not the species on which the phylloxera originally lived. Lastly, the *Vitis vinifera*, the European vine, is the most poorly equipped of all species to resist the insect. The resistance of its roots is the feeblest, and it is extremely difficult for the galls to form on the leaves.

It is the rarity with which galls have been noticed on the vines of the *vinifera* which has brought many authors to say that the gall form is skipped on them, and that the product of the winter egg descends directly to the roots of the vine. This hypothesis has never been sustained by observation. Nevertheless, the doubt exists; and in the book of M. Balbiani, which we have called the work of a master, a certain passage shows that this author was not far from admitting this theory at the time he wrote.\*

We should add here that in a later work he (M. Balbiani) has clearly renounced this theory.†

M. Henneguy, delegate of the Academy of Sciences, is opposed to this theory of the habitual descent of the product of the winter egg to the roots.‡ He gives particulars of an interesting experiment made by M. Savre, professor of the agricultural department of Lot, who used lime wash in

\* M. BALBIANI, page 28, says: "Does the issue of the winter egg always show on the leaves, or does it descend directly to the roots after it is hatched? This cannot be said precisely; it appears that the nature of the vine is not without its influence in deciding this." M. Dr. Fatio (*Le Phylloxera dans le Canton de Geneve en 1876*, page 20) says for his part: "The largest laying insects on the roots, which I call here *Nodicole*, appear to be very probably the direct product of the winter egg; that either the egg hibernated on the roots, or that after the hatching on the wood above ground, the young gall insects enter, prematurely, the soil without forming the gall." Further on M. Fatio is still more affirmative: "The issue of the winter egg, at Geneva, proceed in great majority promptly to the soil in spring."

† BALBIANI: *Rapport au Ministre sur le traitement contre l'œuf d'hiver en 1884*. (*Compte rendu des Travaux du service du Phylloxera*, 1885, page 153.)

‡ HENNEGUY: *Rapport sur la destruction de l'œuf d'hiver*. (*Compte rendu des Travaux du service du Phylloxera*, 1887.)

a treatment against the winter egg, and the experience is worth citing. "The French vines," says M. Henneguy, "such as Malbec, Cot-rouge, etc., were treated with lime wash in the months of February and March, 1886; but the mixture was not applied to any of the wood two years old. The vines presented a goodly number of galls later. This result was wholly natural, since the wood of two years is the preferred location of the winter egg; but the interesting portion of M. Savre's observations is in the fact that the galls came on the leaves of the European vine, where ordinarily their appearance is exceptional. M. Savre thinks that the insects coming from the winter egg were stopped in their descent to the root by the toxic vapors, and went to the leaves and formed the galls. For the same reason the young phylloxera of the second generation remained on the leaves, and the galls multiplied. According to M. Savre the issue of the winter egg goes directly to the roots to form colonies there, but when stopped in this manner the colonies of gall insects appear, even on our European vines."

Many investigators—among them the writer—have sought in vain for the phylloxera coming directly from the winter egg, in the first generation, upon the roots of the vines; having found the first generation on the leaves, we do not believe that in the natural state the insect goes directly to the root. We have for a long time exchanged ideas on this subject with M. Boiteau, as well as with others, and until new proof to the contrary is produced, the observation of M. Savre must be regarded as isolated, and we must abide by the results of the experiments and observations of M. Boiteau, which are without doubt authority.

Returning for details to the notes published in the *Comptes rendus* (April 20 and 27, May 10, June 3, July 8, August 5, and November 3, 1876), and also to the brochure entitled *L'Œuf d'hiver et son produit* (Libourne, Maleville, edit. 1876), and borrowing also from letters received directly from M. Boiteau, we will resume the question. It is true that the parenchyme of the leaves of the *Vitis vinifera* is little favorable for the production of galls; true that the galls are badly developed or in forms of cups; true that there are fewer eggs; true that on the European vines, as early as the second and third generation the young begin to descend to the roots; true that the number of galls is smaller, and that the galls are ordinarily on the first, second, or third leaves from the base of the vine cane, and difficult to see.

This is not to say that on the European vines the gall form is skipped. It must not be forgotten that it was on a French variety, the Tinto, that the galls were first observed in France, by M. Planchon, and that before American vines became widely spread in their use, many observers, such as Planchon, Lichtenstein, Cornu, de Laffite, Henneguy, Lejourdan, Faucon, Boiteau, and the writer, have all seen them on French vines. During the summer of 1888 the galls were common on the collection of French vines at the School of Agriculture at Montpellier.

"Certain years," says M. Boiteau, page 21 of his brochure, "the galls are very abundant on wild vines that may be set in the rows of European vines already attacked." The gall insect appears to recognize there the most favorable conditions for its development. The writer has noticed that whenever the *Vitis riparia* is planted in the vicinity of the *Vitis vinifera*, the winged insects alight preferably on the *riparia*, their

preferred habitat. Knowing this, and knowing the favored spots of laying the winter egg, it might be best to destroy as many winter eggs as possible each year by the use of the lime wash of Balbiani.

The gall insect then exists on European vines when a winter egg has been laid; it is only in that the generations are fewer, less prolific, and that the galls are better hidden that the gall form differs from the gall form on the American vines, and that it is more difficult to prove its presence. \* \* \*

## CHAPTER VII.

### ROOT INSECT.

The root form of the phylloxera is the agamous form, which follows the gall insect, which lives on the roots of the vine, whether coming from the leaves or from preceding generations of the root form which originally came from the gall insect. This form is the most widely and best known, the first one discovered in France, the only one which kills the vine, and it is for the last named reason that it has been called the devastating form. As well as being the best known, and being the most numerous in individuals, it is also the most extraordinary from the fact of its subterranean life. \* \* \*

The presence of the root form in a vineyard is manifested in spots when the vines are sickly. The beginning of these spots is very small, but they enlarge little by little, and usually in three or four years—sometimes in two years—there are dead vines in the center of the spots. Around the dead vines there are others that have few tendrils, and small and frequently yellow leaves, and as the distance from the center of infection increases, the vines gradually take on a more healthy appearance, until no signs of disease are visible.

It must not be thought, however, that whenever sickly vines, or spots, appear in a vineyard, that phylloxera is necessarily present. Without speaking of the *pourridié*, a cryptogamic malady which often produces such effects, the same phenomenon can be produced by the attacks of other insects. Only by the examination of the root itself can the exact cause of the malady be determined.

*Nodosites*.—Under the influence of the attack of the insect, nodosites are formed. These are excrescences of parenchyme, of a bright yellow color, and of many different forms. Sometimes they take the form of a vesicular swelling, occupying part or a whole of the rootlet (see Fig. 9, *b*); sometimes, and more frequently, they take up the extremity of the rootlet.



Fig. 9.

Swelling produced by the attack of phylloxera. *a*, on young roots. *b*, on older roots.



They are generally bent like a bird's head and bill; the insect is located at the deepest point of the bending. (See Fig. 9, a.)

Is this hypertrophy of the tissue due to a venomous liquid injected by the insect? This is not the opinion of M. Cornu, who says, with reason, that the different phylloxeras of the oak, which attack the leaves only, produce brown spots, due to the partial desiccation of the leaves. The action produced by the root form on the young rootlet appears to be due to mechanical causes, the same as the action of the gall insect on the leaf, only the organ of injury is different. Not having the same constitution, the hypertrophy is effected in a different manner. The insect drains the cellules under it; but on the root a great depression is never produced as with a gall. By this depression two things result: The change of the organism, and its hypertrophy. The first is caused by the arrest of development on one side and its continuation on the other; the second proceeds with the multiplication of cellules in a mass, on the other side. With the leaves the mode of growth is different than with the roots. The development proceeds freely on a thin and flat surface, and the gall grows without sensibly deforming the leaf. \* \* \*

Concerning the composition of the tissue of the nodosities, we can note many grains of starch in it, easily observed by means of the ordinary iodine test. It has been said by certain partisans that the presence of the starch was the cause of the disease. "This deposit of starch," says M. Delamotte, "is truly due to the absence of vitality of the cellules," etc.\*

Very frequently on plants said to be resistant, the nodosities decompose with strong heat, and the death of the rootlet follows, but the rapid replacement of the rootlets permits the vine to live. With the European vines this does not hold good. The rootlets succumb, while with resistant vines the hypertrophy of the tissues and their decomposition is limited, the cicatrization of the wound sets in, and the evil is repaired. In that portion of the work in which the defense against phylloxera is treated, the writer will enlarge upon the causes of the resistance of American vines.

*Description of the Root Form.*—This form (see Figs. 10, 11, and 12) is closely related to the last generations of the gall form. Certain individuals are difficult to assign to one form or to the other. \* \* \* Without referring to the many experiments which have placed the gall insects on the roots, the inquiry arises at what point the naturalist is able to distinguish between the two forms.



Fig. 10.  
Young Root  
Phylloxera.

Having sufficiently described the gall form, we will describe the root form comparatively. It is about a millimeter in length in place of a millimeter and a quarter; it has brown salient tubercles on the back; the antennæ are provided with jagged edges; and the number of eggs laid is never over one hundred. As with the gall form, it undergoes three moultings. The tubercles, disposed in longitudinal and transverse lines, number seventy, of which twelve are on the head, twelve on the pro-thorax, eight on the meso-thorax, eight on the meta-thorax, six on the first abdominal ring, and four on the next six rings of the body. The last abdominal ring does not have any. These markings on the skin form,

\* DELAMOTTE: *Monographie du Phylloxera vastatrix*, Alger, Adolphe Jourdan, 1885.

at first, an important difference between the two forms; but after the first moulting, this characteristic nearly disappears. After two or three days they are again visible. \* \* \*

From a morphological and physiological standpoint, what is the nature of the function of the tubercles? No author writing of the phylloxera has spoken of them, save M. Cornu, who has nevertheless described these organs. (Page 205, *et seq.*) M. Balbiani, in writing of the *Phylloxera quercus*, says incidentally that in this species the tubercles have a glandular appearance when placed under the microscope.\*

The question, for the writer's part, can be solved by placing certain related insects under the microscope, and with them these tubercles are for secreting a wax; with the *Phylloxera vastatrix* the same is undoubtedly true, except that the glands have atrophied and the wax is not secreted. There are no tubercles on the winged insect; they are reduced to mere hairs in the sexual insect; slightly apparent in the gall insect; and reappear, though without functions, in the root form and the nymph. They form, in the root insect, cushions to prevent rubbing the skin against the earth. No reason existing for their continuance on the aerial forms of the insect, they disappear.



Fig. 11.

Root Phylloxera—Back view.

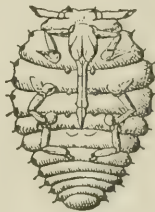


Fig. 12.

Root Phylloxera—View of the front.

Who can say that with certain phylloxera, such as the *Phylloxera quercus*, some of the waxy secretion may not be found?

As with the gall form, the root form undergoes three moultings. They are well described by M. Cornu, page 211. \* \* \*

As we have said, the root form never lays over a hundred eggs. With the gall insect, the last generations, in autumn, may not exceed this number; but with the root form a hundred seems to be the maximum. The progressive degeneration of the production of the ovary appears to find here its confirmation. Starting with the gall insect coming from the winter egg, as many as fifty ovigenous tubes can be found in the ovary. In the spring which follows the descent of the insect to the roots—that is to say, at the greatest generative period of activity—the ovary of the root insect has from twelve to twenty such tubes, and in the autumn no more than six can be counted, or four, and even two. (Balbiani, *Comptes rendus*, January 15, 1883.) In the autumn of 1880, the writer found, at Montpellier, a root insect having but a single ovige-

\* Without taking the reader into the confusion of the two species of the phylloxera of the oak, which have been confounded by many authorities, among them M. Balbiani, we will designate by the name *Phylloxera quercus* the species which he studied so well in comparison with the *Phylloxera vastatrix*. This is not, however, the veritable *Phylloxera quercus*, but is a species common in Northern Europe and known to science as *Phylloxera coccinea*, Heiden. The true *Phylloxera quercus*, that of Boyer de Fonscolombe, is a species common in the central portion of Europe, and very different from that of the north. See on this subject the notes exchanged in 1874 between M. Balbiani and Dr. Signoret; in that of December 7th, Dr. Signoret elucidates well this question.

nous tube, with a single egg in it. The insect becomes, with time, relatively small, and we are led to believe that in the last generations the root form becomes nearly sterile.

However, in the springtime generations relatively prolific succeed those of the autumn in which the reproductive power is small. But this renewal of regenerative power is explained as follows by M. Balbiani: "With the return of vegetation and heat, the number of ovarian tubes does not rise with the descendants of the last laying insects of the autumn. The activity of the laying increases under such influences, and suffices to produce, during a long time, a numerous population of insects." M. Balbiani developed this theory long ago in his response to a note of M. Targioni-Tozzetti (*Comptes rendus*, January 15, 1883). This fecundity, according to him, can be continued for three years without intervention of the sexual insects; and even during four years, according to a note of M. Mares (*Comptes rendus*, September 12, 1877). \* \* \* Kyber succeeded in maintaining under glass for four years the agamous generations of an insect attacking the pink. In his *Monographie des Aphidiens*, page 153, J. Lichtenstein goes much further. "If we are witnesses," says he, "to agamous reproduction during four or five years, why can it not be continued longer? Why will it not continue indefinitely? Reaumur has already asked the question." Here we really leave solid ground and hard facts.

We will refer, as quickly as possible, to the contents of the note of M. Boiteau (*Comptes rendus*, July 18, 1887). We see that the generations, experimentally, had been pushed up to the 25th, and to the month of July of the sixth year. At this epoch in the life-history of the generations there were plenty of insects, and they were still very prolific. To what point can such experiments be pushed? This we await with ordinary interest, for it seems to us difficult in the state of nature to avoid absolutely one of the factors which breaks up such reproduction—that is, the appearance of sexual insects.

We must believe that in the natural state the agamous colonies, if not regenerated by the sexual insects, would gradually be extinguished. They are diminished, besides, in great measure by the considerable number of young root insects which become nymphs, and leave the soil, to be transformed into winged insects. Sometimes the entire colony appears to undergo this transformation in the second year; this has been noted by M. Marion and many other observers. Perhaps this is the normal end of any particular colony of root insects. This presumption, according to M. Balbiani, is proved with the *Phylloxera coccinea*, in which manner entire colonies are dispersed.

Can the root forms go to the leaves and produce galls? Many naturalists have asked this; and M. Marion has asked if the galls which appear sometimes in summer at the extremity of the canes which carried none in spring, do not originate in the soil and proceed thence to the leaves. At present no experiments have been made on this subject, except in the laboratory. In 1870, M. Riley succeeded in transforming the root form into the gall form in an experimental way. M. Marion has obtained the same easily. M. Balbiani (*Comptes rendus*, November 2, 1874) also succeeded in fixing the root form on the leaves in experimental tubes; but the insects placed their sucking apparatus on the lower side of the leaves and no galls were produced. \* \* \* Such experiments, for the writer, do not weaken the regular order of



nature, which is that even if the young root insect leaves the roots, it does so to emigrate, and always goes back to the ground. As for the argument that galls appear in summer when there were none in spring, the same has been seen by the writer, and it is doubtless due to the fact that the gall insect has been carried by the wind or other outside influence to the vine on which no galls appeared in the spring. The wind is a powerful and active agent of dissemination. We will have occasion to return to this subject when we return to the migration of the insect under its different forms.

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## CHAPTER VIII.

### THE HIBERNANTS.

It remains for us to say some words about the hibernants. These are the insects which pass the winter on the large roots of the vine, and which take refuge in cracks of the bark or under the exfoliated corky tissue of the bark. They are sheltered from too great wet, and from immediate contact with the soil. They can be discovered by lifting up the rather loose exterior covering of the bark, and can be seen in groups or isolated. Their color is brown; they are flat and their form is attenuated behind. These legions of parasites are young gall insects which have descended from the leaves and, especially, root insects born late in autumn.

They pass the winter without moving, their sucking apparatus implanted in the bark, and their antennæ folded across the body; they are waiting for fine days to arrive before going to the rootlets and growing. They are generally very small, some having not passed the first moulting, and some not having reached the second; but here and there are found some older insects, which had commenced to lay eggs before the cold came, and which continue slowly to accomplish it. Nearly all the eggs thus laid die; but if the temperature is not lower than 10° Centigrade they hatch, and the young go to increase the number of hibernants. This temperature of 10° Centigrade appears to be the minimum under which the insects become numb, and above which they go out of their torpor. That cold will not kill the hibernants, the winter of 1879-80 proves. In the district about Orleans, in December, 1879, the thermometer descended to -25° and -30° Centigrade, and many of the vines were frozen, but the insects did not disappear. M. Maurice Girard proved, experimentally, by means of freezing mixtures, that the phylloxera would sustain a temperature of -8° and -10° Centigrade without dying. Dr. Horvath, of Buda-Pesth, has carried these experiments further (see Acad. des Sc. de Hongrie Seance, April 23, 1883). In the experimental grounds at Farkasd he exposed phylloxerated roots in open air for a period of eighteen hours to a temperature varying from -1° to -12° Centigrade, and the insect was found to be still living. Now, at the station at Montpellier, in the coldest weather noted, the temperature at the level of the soil was -12° to -13° Centigrade, while at 25 centimeters in depth the temperature was never lower than -1° to -2°. In Herault the hibernants begin to move about the middle of April. At this time of the year sufficient rootlets have developed so that the insect can descend and resume its ravages.

## CHAPTER IX.

## WINGED INSECT.

About the middle of June, the observer can begin to perceive on the young roots, principally at the nodosities, individual insects longer than the others, with legs and antennæ relatively long, supplied with very noticeable tubercles on the back, yellowish-orange in color, and with the ovary little developed and containing no eggs. (See Fig. 13.)



Fig. 13.

Phylloxera destined to be transformed into a nymph.

These special individuals are the larvæ, from which come the nymphs, and from which in turn come the winged insects. They undergo three moultings before being transformed, and the winged insect will be submitted to five before its flight. If one of the larvæ is examined before the fourth moulting and before it has become a nymph, swellings will be noted on the sides from which will eventually develop the wings. The metamorphosis takes place in the soil and usually begins about the 20th of June.

The nymph (Fig. 14) is remarkable for the length of its body, the legs and antennæ, which recall those of the winged insect, and especially for the stumps lying laterally on the sides, on the meso- and meta-thorax. These rudimentary wings are black in color, while the color of the body of the insect is yellowish-gold or orange. The length of the body varies from less than a millimeter to more than a millimeter and a quarter, with the breadth in proportion. As with the root insect, there are seventy tubercles on the dorsal side, and their disposition is the same. The antennæ, lengthened over those of the other agamous forms, have developed a third article, but still has one olfactive stigmatæ. The eyes, numbering three, are of reddish color, are placed in triangular shape behind the antennæ, are larger, more globular, and closer one to the other. When the insect approaches its last transformation the raspberry-shaped eye of the winged insect is plainly visible through the transparent skin.



Fig. 14.

Nymph of the Phylloxera.

At the same time the eggs can be seen forming in the tubes in the ovary; but the nymph never lays an egg, as has been wrongly thought by M. Gerstäcker, of Berlin. The phylloxera while in this form nourishes itself, its feeding apparatus being planted firmly in the nodosities. Its duration in this form is usually six to eight hours, but this can be prolonged if the time is not propitious for the last metamorphosis.

Usually in the morning the nymphs leave the roots in order to be transformed into winged insects on the stump of the vine or the first object reached, or from a fissure in the soil. Some, however, go forth in the evening. This is a time of great movement for them, and their relative activity is great. They go up by the roots to the stump, or else reach the open air by means of a fissure in the soil, and it can be readily understood that soil which cracks and fissures is much more favorable to their flight than sandy soil. In experimental flasks they often start their flight from the glass, affording as it does a solid footing.

A nymph which has left the soil at 6 or 7 o'clock in the morning will complete its metamorphosis toward 9 or 10 o'clock. It is then of a darker color, owing to the loss of the skin, which has been detached. The last moulting can easily be observed, owing to the regularity of the hour, and is very interesting; but we will not enter deeply into the details. The constant movement of the nymph, and the relative dryness of the air, as compared with the soil, facilitates the breaking of the skin and the flight of the insect. The wings are, for the nymph in transformation, a great complication. If it should rain the insect will be held to its place, and will die in one or two days. Even in experimental bottles care must be taken at this period that the flight is not hindered by reason of drops of water on the sides of the glass.

Immediately after the transformation the winged insect is yellowish-gold in color, very pale on the thorax; the wings are white, and the head turned up to enable the insect better to spread the wings by their own weight. By watching the insect at this moment, through a microscope, the air can be seen to enter little by little the trachea, which appears then to be black lines. There are darker bands, which are the nerves. \* \* \* After a delay of about two hours, that is to say, toward mid-day, the teguments of the insect have become sufficiently strong to satisfy the insect to follow its instincts of emigration; but before describing its flight we will give the following description of the insect:

The body (Fig. 15), is quite elongated. It is entirely deprived of the tubercles noted in the root form, and in color is reddish-yellow and orange, except the meso-thorax, which is black. The wings are very long, lie flat on the dorsal side of the body, are clear and transparent and somewhat iridescent. Their microscopic particles or granulations are directed backward, and are imbricated one upon another. The wings are longer than the body by about a millimeter. \* \* \*

The head is remarkable for its eyes and antennæ. The last article of the antennæ is very long, and instead of having one olfactory stigmatite it has two, one at the base and the other in the ordinary position in the other forms. The eyes, which have a reddish color, are multiple and of four sorts: First, the two ordinary groups of three ocelles; second, two large eyes, raspberry-shaped, and formed by the union of many crystalline hemispheres placed laterally above the three primitive eyes; third, a pair of ocelles situated in front between the two large eyes; fourth, an isolated ocelle on the top of the head and between the two antennæ. As this winged insect is designed to go abroad and found new colonies, there is need that its organs of sense be better developed than is the case with the three other forms. The sucking apparatus is shorter than with the agamous, apterous forms. The thorax is a trifle longer than it is broad and is made up of segments, that in the middle (meso-thorax) being black, and the wings are fixed on the dorsal side of the last two segments. The six legs are strongly attached, are long, springy, and are of a deeper yellow color than the body. The abdomen is made up of eight segments, the last ones being



Fig. 15.  
Winged Phylloxera.



thinner than those in front, and the shape of the whole is something like that of a spinning top, owing to a compression of the first segment. The ovary is easy to see with a microscope. There are generally but two ovigenous tubes, but this may vary. The writer has seen instances of but one. Each tube contains two ovules, and but one usually matures. Instances have been known where the winged insect laid eight eggs, but the usual number is two.

Between mid-day and 2 o'clock, if the weather is fine, the winged insect takes flight. In spite of the length of the wings the flight is heavy, and it is only after drawing up its wings to a plane perpendicular with its body, that the insect can launch itself. If the air is calm the insect will fly some tens or hundreds of meters or more; but if the wind is blowing it can be carried many kilometers, and it is to this cause that colonies distant from a place of infection are established normally. Reaching a young and vigorous vine—always chosen in preference to an old or diseased one—the insect alights at the extremity of a cane and quickly goes under a leaf. There it plants its beak, and for about twenty-four hours it feeds. It is then capable of laying; and it is the necessity of satisfying both instincts of emigration and feeding, that makes the problem of securing eggs of the winged insects in an experimental tube so very difficult. Ordinarily in experiments, it dies without having laid, or its eggs are sterile. \* \* \*

The eggs which are laid are of two sorts: larger ones, from which come females, and smaller ones, from which proceed the males. The larger ones are about 0.40 of a millimeter long and 0.20 broad; the smaller ones are 0.26 of a millimeter long by 0.13 broad. The color of the eggs is yellowish-white, and they are more translucent than those of the other agamous forms. M. Balbiani says he has seen both sorts of eggs laid by the same insect. This, however, is rare. Generally the eggs which produce the males are laid by the smaller insects. These two types constitute the colonization form of the insect. They were noticed in 1871 by M. Planchon, who gave them the names of *Androphore* and *Gynephore*. \* \* \*

In the natural state the eggs are laid in groups of two to four, between the veins of the leaves or under the bark of the vine. The number of males produced is two out of ten, according to M. Balbiani. In 1887 the writer obtained a greater proportion—three in ten.

Ordinarily the winged insects are abundant wherever the vines are young. In certain years, however, few can be discovered. They begin to appear about the end of June, and in July they are numerous. August and September are the months when the greatest number is produced. Toward the middle of October there are generally no more. However, in 1888, when the summer and autumn were relatively warm in Languedoc, the writer found many in October, and found nymphs as late as November, from which winged insects were obtained. Lichtenstein made the same observations in 1880, and having taken vines to the hothouses of the Botanical Garden of Montpellier, obtained winged insects even until March, 1881. It is only cold weather which ends their appearance in the central portion of France. It is permissible to suppose that in warmer countries, like Panama, for instance, of which we have already spoken in the chapter on the history of the insect, that the egg produced by the sexual insect is no longer a "winter egg." \* \* \*

## CHAPTER X.

## SEXUAL INSECT.

The two sorts of eggs laid by the winged insect produce the sexual insects. As we have said, two or three small eggs are laid by the winged insects for every seven or eight large eggs. The males produced are in the same relation to the number of females, so that each male can fecundate several females.

The sexual insects are very small, are difficult to find in their natural state, and it can be said that this form, called the regenerator of the race, has been seen on the vines by comparatively few naturalists. In order to see this form at will, the winged insects must lay their eggs in experimental tubes, under the difficult conditions already described, and the hatching, which usually requires about eight days, must be closely watched.

Aside from M. Cornu and M. Balbiani, no one has studied in detail the sexual insect; we must then borrow from their work. The sexual insects of the phylloxera of the vine were first seen by Cornu (*Comptes rendus*, November 3, 1873), and alongside this came the discovery of the sexual insects of the phylloxera of the oak, observed by M. Balbiani (*Comptes rendus*, October 20, 1873). On this subject M. Cornu does full justice to his collaborator, M. Balbiani (page 266), saying: "M. Balbiani observed that the winged insect of the phylloxera of the oak laid eggs of different size and color—some reddish and small, the others yellow and larger; that these eggs soon hatched apterous insects, unsupplied with eating or digestive apparatus; that the small eggs produced males and the others females. After coupling, the female laid a single egg and died. This egg, after being laid did not hatch shortly afterwards, as was the case with the eggs laid by other forms, but a winter passed before the hatching. The egg did not hatch until spring, when the oak produced its first leaves." This egg which goes through the winter without hatching, and which is destined to produce new colonies of insects, was named by M. Balbiani the "winter egg." The hatching of this egg was first announced in the *Comptes rendus*, April 13, 1874. The discovery of the sexual insect without any feeding apparatus was published first on October 20, 1873. Immediately after reading these notes at the time (the fall of 1873), I sought to find the individuals coming after the winged insect, and though the month (October) was very unfavorable, I was fortunate in finding an individual without digestive apparatus. This individual, as well as another which followed, were submitted to M. Balbiani, who recognized them as two females, each with an egg in its abdomen.

We will not insist on this discovery of the sexual females, confirmed two years later by M. Balbiani (*Comptes rendus*, October 4, 1875), as it repeats what was said in the historical sketch of the insect. There remains to be described the sexual insect and its egg. Returning again to the original source of information, the writer cannot do better than quote M. Balbiani:

"The sexual insects of the phylloxera of the vine greatly resemble the sexual form of the phylloxera of the oak. They represent, with them, the lowest form of the species.\* They are incapable of producing their

\* We do not consider, with M. Balbiani, that the sexual form is the lowest. Sexuality is indicative of superiority, both with animals and vegetables.

kind alone, as with the other forms, and isolated are absolutely sterile. Thus they are at the lowest end of the scale; they are designed only to procreate. They do not eat during the few days of their life, having no feeding or digestive organs, and they are sustained only by the substance taken in from the egg in which they are hatched or carried in their bodies.

The male (Fig. 16) is from 0.26 to 0.28 of a millimeter long and 0.12 to 0.14 broad; the female (Fig. 17) is 0.45 to 0.50 of a millimeter long and 0.20 to 0.22 of a millimeter broad, and is thus nearly twice as large as the male.



Fig. 16.  
Sexual Male.



Fig. 17.  
Sexual Female.

The two sexes differ further: First, in color, which is a bright yellow in the male and a pale yellow in the female; second, in the *poils des quatre*, short, stiff, and cylindrical in the male, delicate and finely filiated in the female; third, in the form of the antennæ, the terminal article being thinner at the base with the female. This last article has but one olfactory stigmatæ.

We will complete this description by giving some details of the interior anatomy. The greatest difference between the two forms at first sight is that the female carries a large egg occupying the greater portion of the interior of the body. (See Fig. 17.) The insect when about to lay is little more than an egg mounted on six legs and supplied with antennæ. The ovary is represented by a single sheath, composed of a germinative chamber, which contains the egg and the oviduct. The copulatory sac, according to M. Balbiani, remains always empty, on account of the narrowness of the fecundating canal, and the spermatozoa are deposited in the oviduct. There are also two sebific glands intended to coat the egg at the time of laying; the oviduct is provided with muscular fibers striated transversely and intended to facilitate the expulsion of the egg. In the male, with the assistance of the microscope and a strong light, the body is sufficiently transparent to enable the observer to see the two testicles and two accessory glands. The last segment of the abdomen forms, in its prolongation, a bi-valvular sheath, through which passes the ejaculatory canal and which has the same function as a penis.

Almost immediately after being hatched, which takes place when the winged insects have laid their eggs, whether on the leaves or under the bark, the sexual insects copulate. We have seen that the male can fecundate several females, but as each female has but one egg in its ovary, this must not be considered as extraordinary reproductive power. However, all the females hatched do not copulate. These are the ones that are produced too far from the vicinity of a male, and they either do not lay at all and die, or drop to the ground a sterile egg, which soon dries up.

"At the time of copulation," says M. Balbiani, "the egg is only about



half the size (0.12 to 0.15 of a millimeter in length) that it will subsequently reach (0.27 to 0.30 of a millimeter)." \* \* \*

After fecundation the females leave the leaves or bark where they were hatched and go instinctively to the wood two years or older, the bark being sufficiently adherent to assure the safety of the egg until spring. Once there they place the extremity of the abdomen between two fibers of the bark, and there they laboriously lay the egg—the winter egg—after which, drawn by violent contractions, they soon die. In searching for the winter egg, look for the body of the female, and the egg will not be far from it.

We began the description of the phylloxera of the vine with the winter egg, and we terminate the description here, with its having been laid.

## CHAPTER XI.

### MODE OF THE SPREAD OF THE INSECT.

*By the Winged Insect.*—As we have seen, the winged insect is especially designed to form new colonies. That is its special mission. \* \* The insect does not take its flight when the weather is cold and wet. When the weather is fine and calm, it does not fly farther than some hundreds of meters; but when the wind blows, the insect will be transported—in spite of its naturally heavy flight—some thousands of meters, and with a strong wind, some tens of kilometers. Thus it is that infected spots will break out 40 or 50 kilometers from vineyards already infected. The spread is thus most rapid in the direction of prevailing winds. Very frequently, too, man will unconsciously transport the pest. The delicate insect will alight on his garments, and so make its way, or on wagons or trains. In 1877, after a warm journey from Montpellier to Beziers, the writer noticed, while not far from the latter place, a winged insect alight on an open book held in the hand. At this time the vineyards near Beziers had not been attacked, and the incident was deemed worthy of a public notice.\* How many other people have thus unconsciously carried the insect into vineyards yet unattacked!

*Diffusion of Apterous Forms.*—The apterous forms can also spread from infected spots without the winged insects coming in. Step by step the spreading is accomplished from these spots by the root form, which is always hungry and always agile in moving. When the weather is warm this form will leave the roots by fissures in the soil and go to the roots of neighboring vines. This movement is very considerable, and was first seen and described by M. Faucon, and has since been observed by numerous naturalists.† Even in the case of phylloxera in captivity, one can easily see, from 1 to 5 o'clock, the edge of the bottles covered with a mass of these young emigrants. According to M. Faucon, from 2 to 3 o'clock on the days in the second fortnight of August the greatest of these emigrations take place. The young insects go from enfeebled vines to those more vigorous, and, as it easy to understand, clayey soil, especially where cracked by dryness, is most favorable to such emigrations. In sandy soil, which has no fissures, the sand slips

\* *Messenger Agricole du Midi*, September, 1877, page 312.

† FAUCON: *Modes de Propagation du Phylloxera*, 1874, page 42.

under the insect, the emigrations are all but impossible, and even if a colony of insects is started in such soil, it is not difficult to exterminate it.

The young root phylloxera does not pass from one vine to another underground, unless the roots cross, which is rare. Its feet are unprotected and are poorly fitted to dig through the soil, the integument covering them being very soft and easily broken by the least pressure; further, instinct teaches them to emigrate on the surface of the soil.

Such are the modes of dispersion near and far.

\* \* \* \* \*

The accidental diffusion by man, and his means of transportation, have been alluded to. That of the apterous forms, occasioned by commercial relations, is naturally most frequent, and no one has any doubt that the pest originated in the Old World from the root insect brought from America with rooted vines. Some persons believe that only rooted vines are dangerous sources of spreading the insect, but this is an error. Not only can it be carried on cuttings of two-year wood, but the writer has proved the presence of the young apterous insects on wood a year old.

When the autumn is sufficiently warm to permit vines in protected spots to have leaves and vegetate until the first days of December (which is frequently the case with American vines in Languedoc), the generations of phylloxera continue not only on the roots, but on the leaves; and when the leaves fall the young gall insects can be seen on the canes. \* \* \*

In the journal *La Vigne Americaine*, December, 1882, the writer cited a certain and authentic instance where the phylloxera was carried from France to Hungary.\* In the point in question a lot of American vine cuttings were sent from the station at Arles to M. Horvath, the well-known naturalist at Buda-Pesth. The package, sent from Marseilles to Fiume, was by an accident sent back to Marseilles, and after some other adventures forwarded by rail to Austro-Hungary, arriving at the destination in June, after an eventful travel of more than three months. "On opening the cases," says M. Horvath in his official report to the Hungarian Government, "the canes had begun to vegetate, rootlets were present, and on these were numerous swellings covered by phylloxera."

A very good precaution is to disinfect the cuttings. In the note to *La Vigne Americaine*, the writer advised that they be treated to fumes of sulphurous acid (sulphur fumes), but the success of the experiments of disinfecting with hot water, undertaken by M. Balbiani, followed by the success of the similar experiments by Henneguy and Couanon and Salomon, makes the writer prefer this method, at once simple and efficacious.

M. Balbiani has proved that immersion of the cuttings for one minute in water heated to 50° Centigrade will destroy not only all the phylloxera, but all the eggs.† Below 45° C., during an immersion of five minutes, the number of eggs that survived increased until 42° C., when all survive. This point of 45° is, according to the latest scientific experiments, the point at which the tissue can be completely changed. \* \* \* Viticulturists thus have at hand a practical disinfectant. All that is needed is a "thermometer, water, and a little fire."

\* V. MAYET: *Diffusion des Phylloxeras par les Boutures Americaines*. (*Journal la Vigne Americaine*, December, 1882.)

† *Recherche sur la Vitalité des Œufs des Phylloxeras*. (*Comptes rendus*, 1876, page 1160.)

## CHAPTER XII.

## NATURAL ENEMIES.

Nearly all insects which live on vegetable life have enemies, the mission of which is to restrain too great multiplication and maintain what is called the "equilibrium of species." The phylloxera is no exception to the rule, but is far better protected than many others which live entirely in the open air and are exposed to all attacks. Situated at the bottom of its retreat, the entrance to which is closed by hairs permitting exit and defending entrance, the gall insect is safe from outside attack, and the root insect, from its subterranean life, is not the less protected. It is only the young insects on the canes, leaves, and the surface of the soil that suffer. Without doubt many succumb to the attacks of the *Halysia 12-guttata* and the *Hemerobius perla*; others—even those that have not left the roots—to the *Trombidium*, *Gamasus*, *Tyroglyphus*, and *Hoplophora*. The little myriapod (*Polyxenus lagurus* of Geer) also destroys some. But supposing that hundreds are destroyed by all its enemies. What is this to an insect of which a single female will lay six hundred eggs?

In Europe, a savant beyond the Rhine, our friend Dr. Blankenhorn, of Carlsruhe, has, we believe, accorded these natural enemies of the pest a position of importance, to which they are not entitled. We might also say the same of Dr. Haller of Berne.† \* \* \*

## PART II.

## CHAPTER XIII.

## THE STRUGGLE AGAINST PHYLLOXERA.

We cannot enter into the details of all that has been done in order to resist the phylloxera. What has been done and reduced to scientific treatments would fill a volume. The questions of submersion and the use of American vines, have latterly assumed such great importance that they alone are special studies. We must only touch upon generalities and refer the reader to special works, such as the excellent *Traité de Viticulture* of M. Foëx (Foëx: *Cours Complet de Viticulture*; Montpellier, Coulet; Paris, Delahaye et Lecrosnier, 1888)—a work in which the phylloxera is studied entirely with the view of providing the means of coping with it.

Before attacking any enemy, its position must be studied. We have spoken already of the means of identifying this pest. The preventive treatments are not within the reach of all persons, and this side of the question has an importance which can escape no one.

† DR. HALLER: *Die Kleiner Feinde der Phylloxera*, Heidelberg, 1878.



If there are dead and dying vines in the neighborhood of the vineyards already known to be infected, there is little reason to doubt the cause. It needs but to examine the roots of vines at the edge of the infected spots and which are still vigorous. But in a section where the pest has not yet appeared and no dying spots are yet visible, it is not always easy to discover the phylloxera when it has entered such a vineyard. And as we have said, the *pourridié* (see Foëx, page 502; also P. Viala: *Les Maladies de la Vigne*; Montpellier, Coulet; Paris, Delahaye et Lecrosnier, 1887), a cryptogamic malady of the roots, and the attacks of other insects, may produce similar appearance of the vines.

In order to decide quickly if the phylloxera has a footing in a suspected place, the investigator should examine the rootlets of still vigorous vines, on the edge of a supposedly affected spot. If the vines are not vigorous and the insect has nothing on which to live, it will quickly leave for more vigorous roots, and there is no chance of finding it on dead or dying roots. The investigation is best made between June 15th and July 31st. At that time the vines are in full leaf and growth, the rootlets are forming, and if the insect is there the rootlets are thrown out constantly and bear the nodosities so characteristic. On these swellings, which are often turned up with the first stroke of the mattock, are the yellow or brown insects; the brown ones are surrounded by eggs that resemble sulphur dust. The examination can even be made by using a pocket-knife.

In all other seasons, whether in spring, when the nodosities are not yet produced, or late in autumn, when no more are formed, or in winter, when the hibernant easily conceals itself, the discovery of the insect is more difficult. It is therefore best to make the examination in summer. Once the presence of the pest is certain, action must be taken without delay.

Remedies of all sorts, even to absurdity, have been proposed. The number proposed to different phylloxera commissions and agricultural societies is more than five thousand, and those which have been scientifically and conscientiously tested at the experimental stations at Las Sorres, and at the School of Agriculture at Montpellier, number many hundreds.\*

All of the resources of chemistry have been drawn upon, but few of the long list of preparations have stood the test. As might be thought, insecticides have been largely proposed. The use of insecticides is a direct remedy, but the difficulty of applying them is great. The enemy slips away easily, it is subterranean, hidden often by two meters of earth, and it becomes almost impossible to reach it.

The different methods that have practical value number very few. They can be grouped: (1) as insecticides, such as bisulphide of carbon, sulpho-carbonate of potassium, and lime washes to destroy the winter egg, and finally submersion; (2) processes permitting the vine to live

\*In 1877, the Departmental Commission of Herault, presided over by M. H. Mares, had, since its creation in 1872, received word of 696 processes against the malady, nearly all of which were competing for the prize of 300,000 francs. In a period of five years, 317 had been tested at the experimental station of Las Sorres, near Montpellier, and the results collaborated by Professors Durand and Jeannenot, of the School of Agriculture, were published in a large volume. (Montpellier, Grallier, 1877.) This volume can be read with profit by those who talk of intercalary culture, of cultivating plants strongly odorous at the root of each vine, of pharmaceutical preparations introduced into the wood. As will be seen, everything has been tried—euphorbia, turpentine, garlic, and gray unguent, from lavender to vinegar, from rue to camphor, from asafetida to sealing wax—for catching the insects.

without outside assistance, such as planting in sandy soil and the use of American vines. In writing of these we will follow this order of treatment.

## CHAPTER XIV.

### BISULPHIDE OF CARBON.

This liquid, known for a long time, is a powerful insecticide, volatilizes rapidly, and its vapor is heavier than the air. Otherwise said, its heavy vapor always tends to sink into the soil and not leave it.



Fig. 18.

Treatment of vines with bisulphide of carbon. Taken from the work of M. Barral, entitled *La Lutte le Contre Phylloxera*.

Its employment was first suggested in 1869 by Baron Thenard, but the first experiments made near Bordeaux were not at all successful. If the dose is too strong the vine succumbs, and for some years it was not used. The idea was revived, however, at Montpellier in 1873, by M. Monestier, who, using much smaller quantities of the liquid, succeeded so well at once that the whole problem of dealing with the pest seemed to be solved. But experiments at once undertaken in different soils made it apparent that special conditions of the soil must be met in order to insure a sufficient diffusion of the vapors and the death of the greater portion of the insects.

In argillaceous and compact soils the check to this work is ordinarily complete.

The shallow, stony soils, dry, situated on hillsides, such as the

*garrigues* of Languedoc, are likewise rebellious to treatment by bisulphide. However, in such soils M. Thiollière, of Isle, has obtained success on the hillsides of Hermitage, but the ground was dug up, it is true, to a depth of one meter. In light, sandy soils the toxic vapors can escape, and in case of success the query might be propounded, whether such soils did not prevent the multiplication of the insects. Soils of medium consistency are those in which the best results are to be obtained, and this is fully evidenced by the results of M. Jaussan, of Beziers, and Messrs. Allies and Marion, of Marseilles, the latter working for the account of the company, P. L. M., which are known to all.\*

This medium of conditions is more difficult to appreciate. The soil must be neither too wet nor too dry; and it is easy to understand that as water is present in the soil in more or less quantity, it increases or diminishes the density of the soil.

"The treatments," says M. Foëx (page 565), "must be begun when the first traces of the work of the phylloxera are seen. If nothing is done until the effects are strongly shown—a time which corresponds with the destruction of a great portion of the root system, it may require some years for the vine to recover, by being rid of the insects and throwing out new rootlets. But if action is taken at once, at the beginning, most of the rootlets can be saved, and the vineyard will not suffer sensibly. Added to this, if the vines are badly affected by the pest, they are also very sensibly affected by the bisulphide, and the quantity of the liquid that can be used with safety will not be enough to quickly destroy the insects.

"Regarding the best season for operating, it is possible, under certain conditions, to work with equal success at any season of the year. The time of an excess of moisture must be avoided, as at such times the bisulphide will evaporate too slowly, and in the liquid state it will alter the roots. Also, it is best not to work in times when the soil is very dry, as the soil is split and cracked and the vapor will escape too freely. Neither should the time of flowering or of the vintage be chosen, because there always occurs with the treatment a partial cessation of the functions of a certain number of rootlets and a slight arrest of vegetation. The effect—stupefaction, it is called—may bring on coulure, if the treatment is early in the spring, or it may harm the maturing of the fruit, if the treatment is late."

M. Monestier operated by thrusting a stake into the ground and putting the liquid at the bottom of the hole, then closing the hole by a vigorous stroke of the heel. This was the method by which the bisulphide was first used. Since that time numerous processes have been devised; such as the bottles of Fouque buried in the ground, which permit the escape of the toxic vapor through the stopper; the cubes of Rohart, in which the sulphide is contained in porous wood by means of a special varnish, the fumes being liberated at the desired time by rupturing this coating; the aspirator and insufflator of Crolas and Jobart, an ingenious apparatus which is designed to produce a better diffusion of the insecticide, etc. To-day the apparatus most in use are stake injectors (*pais injecteurs*) and bisulphide plows (*charrues sulphureuses*), both being cheapest in price and doing the best work.

\* CIE. DES CHEMINS DE FER DE P. L. M.: *Résumé des Travaux effectués pour combattre le phylloxera*, par A. F. Marion, Paul Dupont, 1878.



"The first of these instruments," says M. Foëx (page 567), "are the ordinary injectors; the plows are of more recent invention. Their employment tends to spread, as their use results in great economy. The first injectors used were simple tubes open at the lower portion. These tubes were driven into the ground and had an iron point at the end, which could be removed at will when the tube had reached the desired depth, and the desired quantity of liquid was permitted to enter the soil. Next these injectors were made having a gauging apparatus. Then the

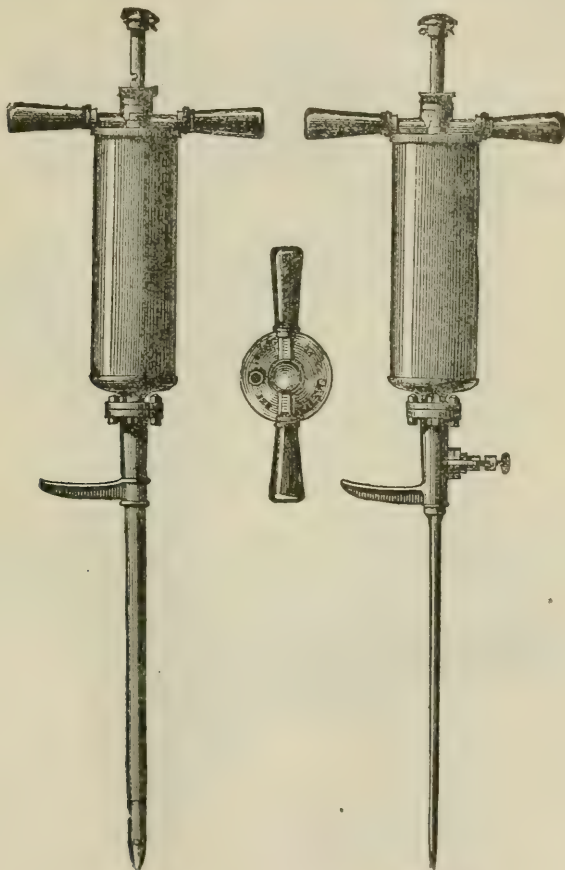


Fig. 19.  
Gastine Injector.

Fig. 20.  
Gastine Injector, with stem sword-shaped.

Gastine injectors came in, which are described by M. Gastine as follows:\*

"As can be seen from Figures 19 and 20, the injector is a portable apparatus, composed of a cylindrical reservoir terminated by a perforating tube. Above the reservoir are two small handles for handling the instrument and for aiding in driving it into the soil. A hydraulic pump is placed in the interior of the reservoir, and the piston-rod of

\* The injector is manufactured by the Société l'Avenir Viticole, Rue de Brueys 73, Marseilles; and M. Vermorel, Villefranche, Rhone, makes the same slightly modified.

this passes at the top between and above the two handles, and seems to eject the desired quantity of liquid.

"The method of using is as follows: The apparatus is taken by the handles and the stem driven into the ground. If the power of the hands on the handles is insufficient to drive the stem as deeply as desired, the force can be increased by placing the foot on the pedal shown in the cut. As soon as the desired depth is obtained the piston is worked quickly up and down, producing the ejection of the liquid at the bottom of the hole.

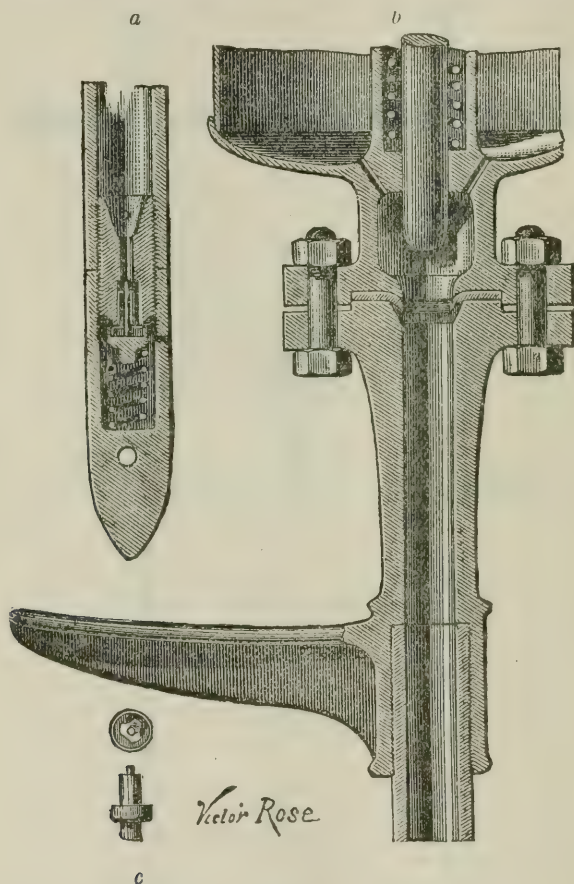


Fig. 21.

Details of Gastine Injector; c, valve.

The piston is then released and the interior of the reservoir is so arranged that the liquid for the next operation gets in the proper place automatically.

"The operation is thus reduced to the following: (1) Driving the stem into the ground; (2) working the piston-rod; (3) drawing the stem from the ground; (4) closing immediately, and with force, the hole made by the instrument.

"The quantity of bisulphide used with each charge can be regulated

by the length of the stroke of the piston, which in turn can be regulated by a ring on the piston-rod."

The depth of placing the charge must be from 0.3 to 0.4 of a meter, except when the liquid is placed near to the foot of a vine, when it should not be over 0.08 or 0.1 of a meter. The charges should be placed in regular rows parallel to the rows of vines and at intervals of 0.6 to 0.88 of a meter apart. \* \* \* In light soils the liquid may be placed in the soil closer to the vine stocks than with heavy soils, but the charge must be put deeper in the ground than in the case of heavy soils, on account of the ease with which the liquid evaporates and diffuses.

In conclusion, the number of ejections of liquid to the square meter varies under different circumstances. The general rule can be established that the more the bisulphide is applied to the soil, in small doses, the better the diffusion of the vapors. But if the number of oper-

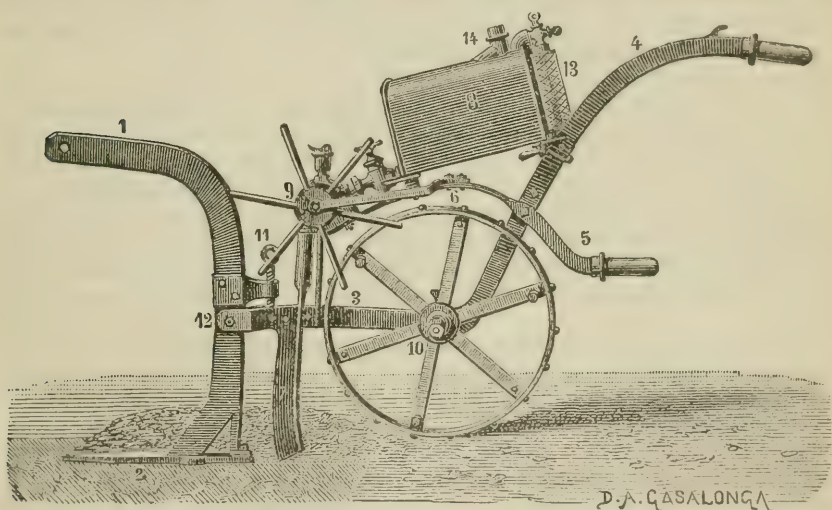


Fig. 22.

Bisulphide Plow of M. E. Vernet, of Beziers.

ations is made too numerous, the cost of labor will become too great. The mean number of ejections to the square meter is usually limited to two or three, and this will be found sufficient in soils of medium consistency. In compact soils, four will be found better.

*Bisulphide Plows.*—These plows are so arranged as to permit the deposit of bisulphide in a continuous line. These tools are of recent invention, but nevertheless their use is spreading rapidly. If the vines are planted in regular rows they permit rapid and economical work. As can be imagined, there are several types of these plows, and among the most used are those of M. Gastine, of M. Vernet, and of M. Saturnin.

The plow of M. Vernet (see Fig. 22) is most in use in Languedoc and is essentially composed of a share, 2; a receptacle, 8, which carries the liquid; an ejecting apparatus, 9, which gauges the amount of liquid flowing out of the tube into the bottom of the furrow; a wheel, 10, which covers up the furrow and communicates the movement to the



ejector, 9; and lastly, two handles, 4 and 5, the first to guide the plow when it is working, and the last to lift it at the end of a row.

The lines drawn by the plow should be about a meter apart at the greatest. According to Gastine and Couanon it is necessary to make but one furrow between the vines if they are 1 meter or 1.2 meters apart. If the spacing is from 1.2 meters to 2 meters, it is best to make two. If the espacement is between 2 and 3 meters, it is best to make three such lines of injection.

The plow must be regulated so that the delivery of liquid is proportional to the espacement; the tables prepared especially for each type of plow furnish the needful information on this subject.

Whenever a bisulphide plow is used, the soil is usually harder than with the hand ejector, and the depth at which the liquid is deposited is less, ordinarily about 20 centimeters at the greatest. It is consequently inadvisable to till the soil before this treatment (though some viticulturists seem to think it useful), for the loosening of the soil will give the vapor of the bisulphide too free access to the air.

At first the quantity used was entirely too large, and the operators did not think of the effect of the insecticide while trying to save their vines. Thus it was that Baron Thenard at first used 100 grams for each vine. Later M. Allies used 30 grams per vine. The Commission of the P. L. M. Railway Company was the first to propose two treatments each of 30 grams of bisulphide per square meter, which equals 300 kilograms per hectare, and two treatments thus calling for 600 kilograms per hectare (about 1,320 pounds for each  $2\frac{1}{2}$  acres). The members of this Commission now know that good results can be obtained with much less quantities.

The Viticultural Association of Libourne, working in a locality where the multiplication of the phylloxera is comparatively slow, and where, on account of the humidity of the soil, the loss of bisulphide by evaporation is small, decided upon the use of 250 kilograms (550 pounds) per hectare ( $2\frac{1}{2}$  acres). To-day in certain localities where the pest is comparatively easily fought, not over 15 grams per square meter, or 150 kilograms per hectare (330 pounds per  $2\frac{1}{2}$  acres) is used. As low as 120 kilograms have been used. As a rule it may be said that the usual annual treatment calls for 150 to 250 kilograms per hectare.

*Extinction Treatment.*—It is also in place to speak of the efforts to extinguish the disease by destroying the vines, the method conforming to special laws adopted first in Switzerland and later in Algeria, Germany, and Russia. This method, excellent in countries in which the vines are little affected, has in view, by the application of a single strong dose of insecticide by means of an injector, to kill not only the insects but the vines, and to stamp out if possible all infected spots.

The Swiss law was enacted in 1878. The writer was charged personally, in 1882, by the Academy of Sciences, with a mission to study the efficiency of these measures of extinction, and we will reproduce here a portion of what we then said in a letter to M. Dumas.\*

"In the two cantons of which the vines are attacked—Geneva and Neuchâtel—the bisulphide was applied at the rate of 300 grams per vine—150 grams being first used and 150 grams after an interval of twelve days. The vine was killed ninety-nine times out of one hundred,

\* VALÉRY MAYET: *Comptes rendus*, November 20, 1882. For details, consult the *Comptes rendus* of the Academy of Sciences.

and the vines on the edges of the infected spot were always treated. Under this energetic treatment, all organized life was killed—such as snails, earthworms, all insects, weeds, vines—everything. Five rows of vines surrounding the affected spots were thus treated. As the treatment was not in circles but in square blocks, the number of vines destroyed is easy to calculate. Sometimes vines in a square 50 meters on each side were destroyed, involving 25,000 to 30,000 vines for each point. \* \* \*

“The cost of this treatment of extinction, of visits by experts, of surveillance was met, one third by the Confederation, one third by the Canton, and one third by the Cantonal Council, in the form of a tax. This tax falls upon the vineyard proprietors exclusively, and is assessed according to the value of their vineyards. It varies from 5 to 15 francs per hectare. For the time being infected vineyard spots become virtually the property of the State; they are surrounded by a cordon supported by stakes, marked by a flag, and notice is put up bearing the words ‘*Vigne séquestrée*’ (sequestered vines).

“For five years afterward no vines can be planted on such spots. Indemnity is paid for two years. The first year this equals the value of the crop, and the vine stumps, stakes, etc., which are burned on the spot. The second year the indemnity equals the value of half the crop.

“The most active search for infected vines is made in the month of July, the time when the most rootlets are produced, when the presence of the pest can be most easily discovered, and when the emigration of the winged and apterous insects begins. The treatment at this time of the year ‘kills two birds with one stone.’ It kills the pest and prevents emigration of the colonizing insects.”

Can it be said, in view of these details, that the Swiss have solved the problem? Certainly not. The recent new attacks in the canton of Vaud and the extension of the pest in Neuchâtel prove that, in spite of all the energy displayed, the insect still spreads, and that it is likely any day to invade the thousands of hectares of vines on the northern border of Lakes Geneva, of Neuchâtel, and of Bienne. Nevertheless, it is true that though Switzerland has had the pest for about twenty years, the people, by an annual expenditure of 50,000 to 60,000 francs (the interest on a little over a million francs), have defended for a long time vineyards representing a capital of over a milliard of francs.

The French law regarding Algeria is dated March 21, 1883; the German law is of July 3d of the same year; the Russian imperial ordinance bears the date of February 5, 1885. They resemble the Swiss law in general tenor, except that Article 8 of the French law made the communes bear the expense of the annual campaign. “This disposition,” says M. Couanon, Inspector of the Phylloxera Service, in 1886, “was not equitable, because it made all bear an expense for the sole benefit of a certain number and class. The communal resources are frequently insufficient; and the majority of Algerian vignerons object to the establishment of a special tax bearing on all vines. This proposition has been proved by the new law of July 28, 1886. By the terms of this law, the tax and its scaling—the maximum tax is 5 francs per hectare—is determined each year by decree of the Governor-General, with the advice of the General Council. The rate in 1887 was 3 francs, and the sum imposable on 50,489 hectares in three departments made the total resources 151,467 francs.”

This sum is more than sufficient for the annual work ; but the question arises, has the treatment by extinction been any more successful in Algeria than in Switzerland or Germany ? In his report on the campaign of 1886, M. Couanon was evidently full of confidence in the future of our colony ; but such is evidently not the opinion of M. Tisserand, who, in his report to the Phylloxera Commission, said that the situation about Philippeville in 1887-8 was very grave. "The infected spots," says he, "are disseminated over a massive vineyard area, and there is reason to fear that in spite of the energy displayed, the insect will extend its ravages very materially. About La Calle, the most important, the contagion appears well advanced."

To conclude: The bisulphide appears to be most efficacious in light soils; in the north of France, rather than in the central portion; and that the insecticide should be used at the first sign of invasion. In the northern portion of France, where the soils are cold and clayey, and where the multiplication of the pest is slow, sometimes the attacked vines will last ten years after being attacked, and under such conditions there is some hope in using the insecticide. The same cannot be said in the central portions of France, where the vine will sometimes die in two years. Even the most careful vigneron cannot meet the emergency, and the bisulphide can only be considered as an ameliorating agent. But if the aim is to treat the infected spots by extinction of all life, the bisulphide is the best agent that can be used.

*Bisulphide of Carbon Dissolved in Water.*—Owing to a number of accidents, where the vines were either killed or badly injured by using the bisulphide in its natural state, the idea of dissolving it in water occurred to many of our inventive minds. A more regular distribution of the insecticide in the soil is thus secured. At first the proposition was vigorously debated, but as the practice spread it received commensurate approbation. On this subject we cannot do better than to quote M. Foëx:

"M. Cauvy, Professor of Physics at the Pharmaceutical School at Montpellier, first proposed this in 1875, but he did not follow up the idea. In 1882, M. Rommier, who was studying the phylloxera question for the Academy of Sciences, made the same proposition. He studied, in the first place, the solubility of the bisulphide in water; and ascertained that it was about two grams per liter at an ordinary temperature. However, to avoid all accidents, he recommends that the quantity used be never more than 0.4 to 0.5 of a gram per liter."

"In practice," says he (Journal of Agriculture, August 26, 1882), "the operator must secure a reservoir provided with wings or stirrers (a species of churn as it were), in which to thoroughly mix the two liquids, the mixture being diluted afterward." \* \* \*

The imperfection of this apparatus prevented, at first, the employment of the method, and it is only in the past four years, or thereabouts, that, thanks to the very ingenious apparatus devised by Fafeur Brothers, any considerable area of ground has been treated by this method.

Messrs. Fafeur Brothers describe their apparatus as follows:

"Figure 23 enables us to explain the principles and action of the apparatus.

"The shaft A B is contracted at O and the current of water flows in the direction of the arrow F. The pressure exerted by the current of



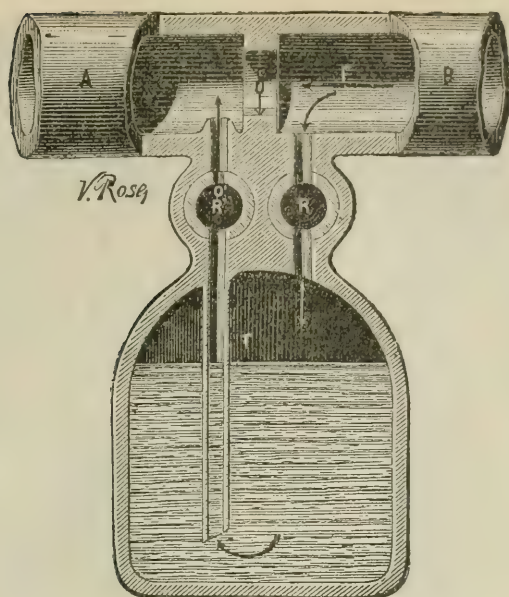


Fig. 23.

Plan of the apparatus of Fafeur for dissolving bisulphide of carbon in water. (According to M. G. Foëx.)

water (produced by the contraction at O) is brought to bear on the recipient, which is kept full of water and bisulphide, the latter, by reason of its greater density, occupying the lower part of the vessel. The pressure is transmitted to the bisulphide, which then rises in the tube T, passes through the stopcock R' and the orifice O', and comes out into the tube A, where it meets the jet of water flowing through O. The relative delivery of water at O, and of bisulphide at O', regulates the proportions of the two liquids in the mixture; and the stopcock at R' also regulates the delivery of bisulphide. A stopcock at R enables the operator to shut off the current of water flowing toward the bisulphide, when it is desired to re-charge the apparatus with bisulphide. \* \* \*

"Inasmuch as the jet of bisulphide is created by the current of water itself, the proportions in the mixture will always be constant.

"As can be imagined, it is easy to adapt this system to many different conditions, and the current of water can be produced as desired, by pressure from a reservoir of water, by a hand pump or steam pump. For small operations the hand pump shown in Fig. 24 will suffice.

"The mode of treatment consists in previously digging a small basin around every vine stump, and pouring into each basin a quantity sufficient to equal 15 to 18 liters of solution to every square meter of surface; that is to say, if there are 8,000 such basins to the hectare, 20 liters can be placed in each one, which is equivalent to 16 liters per square meter. If there are 3,000 such basins to the hectare at least 50 liters should be poured in each; and if there are 2,500 basins, 60 liters in each. In very closely planted vineyards, two vines can be included in each basin, and

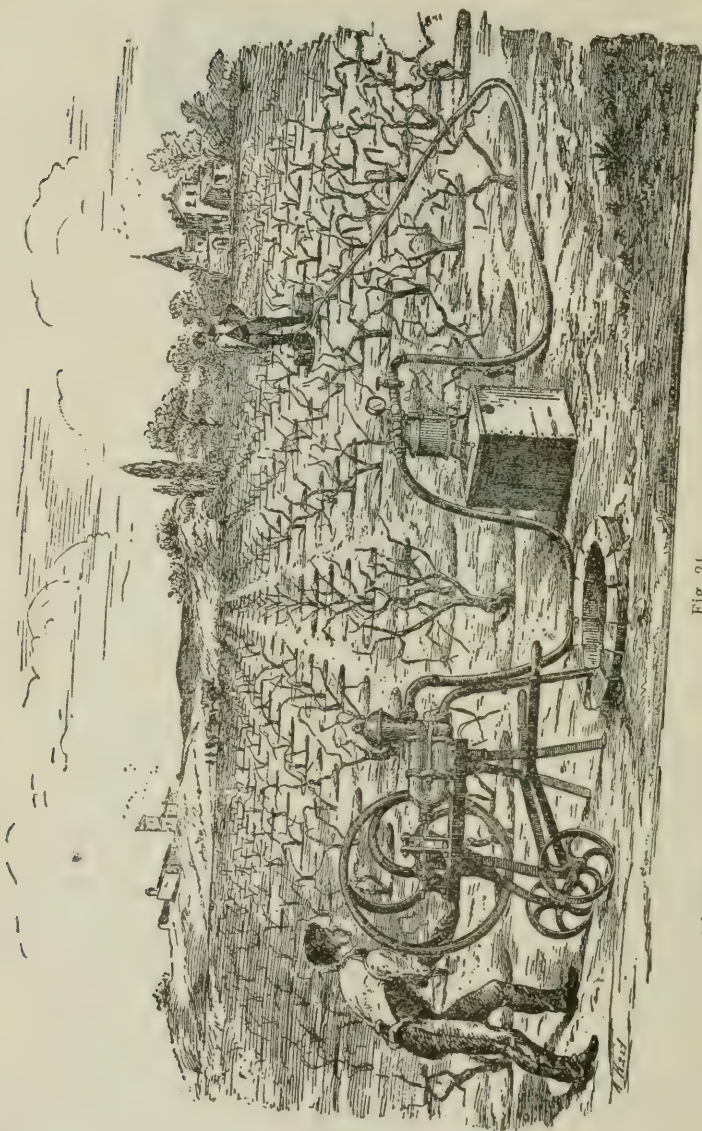


Fig. 24.  
Adaptation of the Faifeur apparatus for a hand pump. (According to M. G. Foëx.)

if there are as many as 30,000 vines to the hectare, three vines can be included.

"If it is desired to treat only a small surface of the land, and if the water supply is convenient, a hand pump will suffice, and rubber hose can be used to carry the liquid to the vines to be treated. A man or boy can direct the stream as it comes from the pump into two tubs alternately, one being emptied while the other is filled."

For large or medium-sized vineyards a steam pump will be found better, placed on the border of a stream or at a well having sufficient



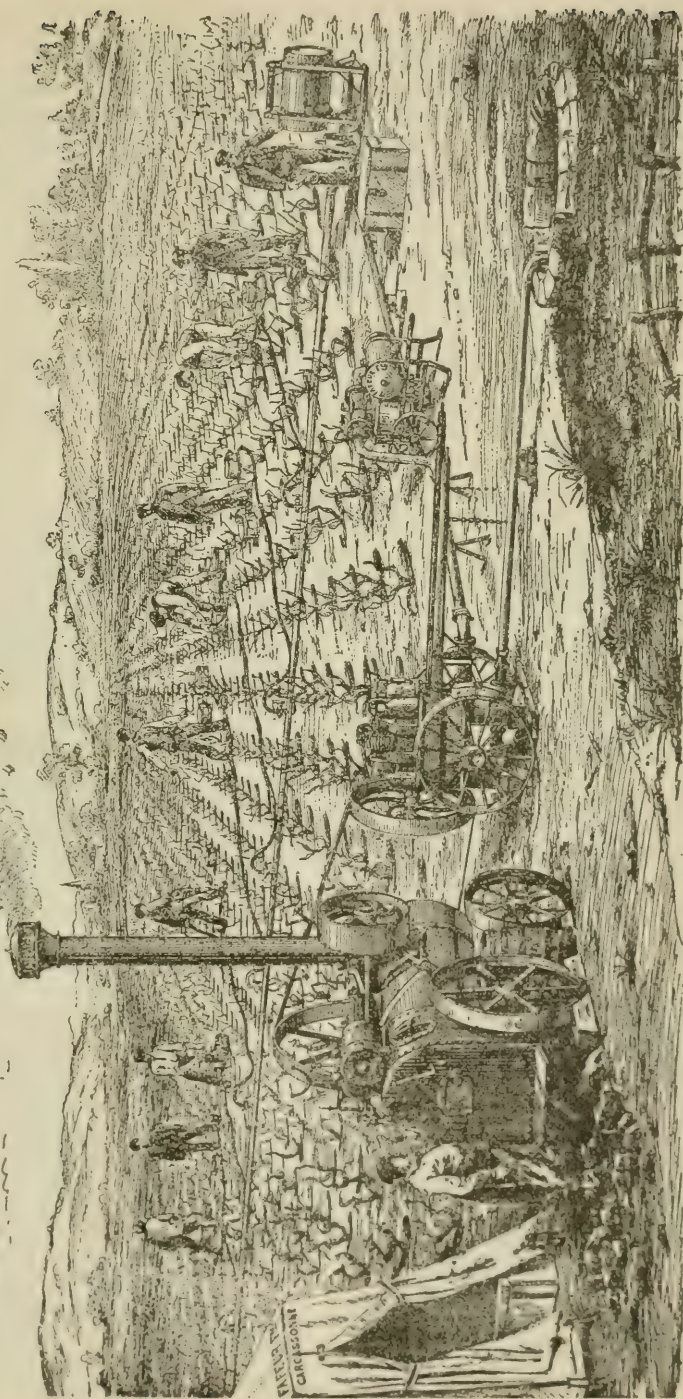


Fig. 25. Arrangement adopted for employing the Fafeur apparatus when a steam pump is used. (According to M. G. Focx.)



water supply. The pump is connected with the dissolving apparatus. \* \* \* The details can be seen in Figs. 24 and 25. \* \* \* The treatment can be made at any season, excepting at the time of vintage.

As can be seen by the above details, about 1,600 hectoliters of water for each hectare of vines will be needed. More will be required if the ground is rolling. The process can only be applied when the water supply is abundant. In spite of this, the process tends, in the valley or rather the great plain of Aude, to replace the employment of bisulphide or the alkaline sulpho-carbonates. But can the French vines in this section be saved by this treatment? We do not believe it; but nevertheless we believe their death will be deferred for some time.

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## CHAPTER XV.

### SULPHO-CARBONATES.

From the first invasion of the phylloxera, the discovery of an agent at once a fertilizer and an insecticide attracted the attention of chemists. Many experiments were made in that direction; but the idea that the sulpho-carbonates of potassium and of sodium would unite both qualities is due to M. Dumas. In 1874 he observed that under the influence of the carbonic acid in the air, and of humidity, these salts decomposed slowly, forming the carbonates (fertilizers) and bisulphide of carbon (an insecticide), and that, further, the slowness of the reaction gave the toxic vapors a long and efficacious action.

Experiments were then undertaken at Cognac under the direction of two delegates from the Academy of Sciences. Those intrusted to M. Max Cornu and M. Mouillefert resulted in a remarkable growth of rootlets and that the insecticide did its work, and the sulpho-carbonate of potassium was found preferable to the sodium salt, notwithstanding its greater price. The fertilizing value of the potassium salts was already well known; bisulphide had been proved to be a powerful insecticide, and it was believed that the remedy had been found and that everywhere it would supplant the bisulphide of carbon treatment. That availed nothing. Though the process was ingenious and the name of its discoverer carries weight, practical work must decide.

The statistics given in 1888 by the Director-General of Agriculture (in his review of the situation pertaining to phylloxera) prove that the bisulphide of carbon still has the great preference among vignerons.

In 1886 the number of hectares of vines treated in France by bisulphide of carbon was 47,215, and the number treated by sulpho-carbonate of potassium was 4,459; the figures for 1887 were 66,205 hectares by bisulphide, and 8,820 hectares by the sulpho-carbonate. Comparing only these two years, it might be thought that there was a growing confidence in the sulpho-carbonate; but the year 1884 shows 33,446 hectares for bisulphide and 6,286 hectares for sulpho-carbonate; the year 1885, 40,585 hectares for bisulphide and 5,227 for sulpho-carbonate.

Why the relatively low proportion of sulpho-carbonate? We will explain by borrowing the words of an author from whom we have already borrowed freely:

"The sulpho-carbonate of potassium," says M. Foëx, "is employed

diluted in water, and water in sufficient quantity to saturate all the ground in which the roots live. Large quantities of water must be had; and this is one of the most serious objections made to the treatment. It must be applied in winter, the season when the vine is at rest and gets little nourishment from the sulpho-carbonate, while the soil is probably already well saturated with water. M. Mouillefert recommends, however, a second operation, to be conducted in the month of July, if the vines are already badly attacked, on account of the great multiplication of insects at this period of the year.

"Clayey soils are not at all favorable for treatment by this method; the insecticide penetrates such soils too slowly when they are already wet, and in this case the liquid remains too long in the open air and loses its efficacy. Furthermore, the potash does not get into such soils as quickly as desirable, and its fertilizing powers are not utilized as in other soils. Finally, as these soils warm up very slowly in the spring, the rootlets, which keep up the strength of the vine, are produced very slowly, while the facility with which these soils crack gives every opportunity for the insects to escape and enter upon new fields of attack."

#### APPLICATION OF SULPHO-CARBONATE.

"The sulpho-carbonate, dissolved in water, is poured into little basins dug at the foot of the vine stumps, and as soon as the liquid is absorbed by the soil they are covered up. The size of these basins varies according to the method of planting the vines and the declivity of the ground. If the vines are closely planted they may inclose two or more vines. Ordinarily this work is done by hand, but a plow may be used in certain cases, if the rows thrown up by it can be connected by use of a hoe. It is best to do this work but a short time before applying the remedy, as the freshly turned earth more easily absorbs the solution.

"The preliminary work done, the operator places in each recipient or basin the equivalent of 40 to 50 grams of sulpho-carbonate per square meter, mixed with 10 to 15 liters of water, according to the permeability of the soil; this represents a total of 400 to 500 kilograms of sulpho-carbonate and 100 to 150 cubic meters of water for every hectare treated.

"The economical transportation and handling of this great quantity of water has been the object of deep study on the part of Messrs. Mouillefert and Hembert. They have devised a system which appears to possess in a remarkable degree the necessary conditions of cheapness and convenience. Their system consists of: First, any sort of motor; second, a suction pump operated by the motor, together with suitable reservoirs for water; third, a special metallic system of canals, very light, and permitting of easy setting up and taking down; fourth, a secondary system by which the liquid can be conveyed to any part of the vineyard; fifth, a certain number of reservoirs at different parts of the system, which will permit the regulation of the pressure all over the treated vines; sixth, special receptacles for receiving and distributing the liquid, and in which it can be prepared; seventh, finally, apparatus for distributing the solution."

These tools are worked as follows, according to M. Mouillefert: "The pump and the motor are placed by the water supply. The water is carried to the principal canal system, then to the secondary system, which forms a network in the vineyard. At intervals of about 20



meters on this secondary system are stopcocks, to which can be attached rubber hose about 10 meters in length, forming a complete system of distribution. The liquid is distributed finally by two buckets or tubs of 350 to 400 liters capacity, easily handled by a man, which receive the water from the rubber hose. When one of those buckets or tubs is full, the needful quantity of sulpho-carbonate is added in order to treat a given number of vines. The mixture is agitated until the solution is perfect. The workman has then only to carry the solution by means of two watering pots, to the vines desired to be treated.

"The reservoirs, placed usually at elevated points, serve to accumulate water which is not for the time needed. \* \* \*

"If the system is well organized, it will not be necessary to carry the solution at any place for a greater distance than 10 meters. Under such conditions a man supplied with two watering pots can empty at the foot of the vines, from 1,500 to 1,800 liters of solution per hour, without in the least being pushed.

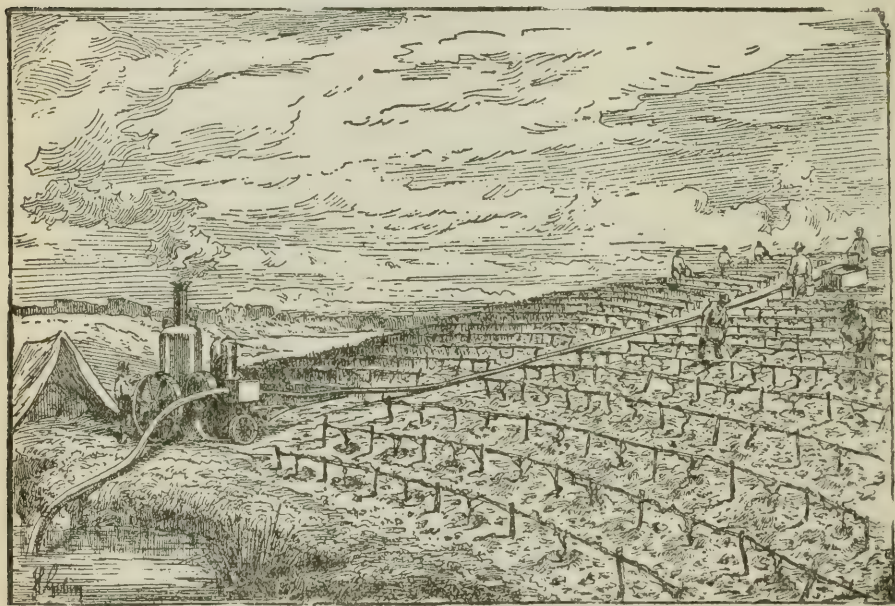


Fig. 26.

Treatment of a vineyard with sulpho-carbonate of potassium, according to the process of Messrs. Mouillefert and Hèmbert. (Extracted from the book of M. Barral: *La Lutte contre le Phylloxera*.)

"Notwithstanding the ingenuity of the processes thus described, and the considerable saving consequent upon their use, the employment of sulpho-carbonate is nevertheless more costly than that of the bisulphide. It is only where crops are large, or where there is reason to fear the use of bisulphide, or where there is already, by reason of the situation of the vines, a certain resistance, that the use of sulpho-carbonate is to be preferred. But under these circumstances there is the additional advantage of leaving in the soil a fertilizer very welcome to the vine, and the value of which must be deducted from the cost of treatment."



## CHAPTER XVI.

## LIME WASHES AGAINST THE WINTER EGG.

We have already treated very clearly the theory of M. Balbiani on the gradual diminution of the fecundity of the successive generations of phylloxera and its complete and inevitable extinction through this diminution of fecundity and the diminution and final disappearance of the tubes of the ovary, were it not for the appearance of the sexual insects, which in a moment regenerate the race.

This manner of conceiving the cycle of life of the phylloxera is based on numerous facts and experiments, and until proved to the contrary must be considered as good. It is conformable to the logic that in insect life there can be no perpetuity of species by parthenogenesis, and at present there is no theory that weakens the premise.

In undertaking a campaign against the beginning and end of the species, the winter egg, we do not go far from a campaign against the entire species. \* \* \*

On the 13th of January, 1882, in accordance with the views of M. Balbiani, the Superior Phylloxera Commission issued the following statement:

"Considering the importance of the rôle of the winter egg in regenerating and perpetuating the insect; and with a view of practically encompassing its destruction, not only in the laboratory but in the vineyard, the method of attaining this end becomes a matter of importance."

This statement, addressed to the Minister of Agriculture, was taken under consideration, and the experiments to follow were intrusted to M. Balbiani. But the needful preparations for a test on suitable ground took some time. During the winter of 1882-83 a first experiment was made, followed by others in the next year, which were crowned with success. Let us take the words of M. Balbiani:\*

"The experiment consisted in choosing vines which habitually (naturally) showed many galls, and treating a certain number with the wash, while permitting others near by to go untreated. *Riparia* vines on the domain of *la Paille*, near Montpellier, were found to unite the needful conditions. The leaves (the vines were four years old) were covered each year with many galls. In the month of February, 1883, half of the vines were treated to a wash of a mixture of coal tar and oil, while the other half were not treated. Unfortunately this first experiment failed. It was expected that in the spring the galls would not appear on the treated vines and would appear on the untreated vines. As a matter of fact they did not appear on either; the season of 1883 was not favorable for the production of galls. Where they usually appeared in greater or less number, there were scarcely any. This was notably true with the vines of M. Laliman, of Bordeaux, where usually there are many galls each year.

"The experiment was repeated in the winter of 1883-84, and was this time crowned with complete success. M. Henneguy, who visited the experimental plot on April 10th, noted that the vines not treated showed numerous galls; on the contrary, where the vines had been treated, not a single gall could be found after a diligent search. The vines were

\* BALBIANI: *Compte rendu des Travaux du Service du Phylloxera*, 1885, page 157.

examined by Messrs. Couanon and Mouillefert on May 4th, and both of these gentlemen were struck by the clearness of the result. On June 1st, I examined them, in company with Messrs. H. Mares, Henneguy, and Couanon. At that date the difference between the two was more clearly defined than ever. On the vines not treated the galls had multiplied enormously in number, to the point of there being scarcely a free spot on the leaves, while with the vines treated the leaves were free from galls."

The writer can add that many visits to the experimental plots have convinced him of the efficacy of the treatment. While very efficacious in dealing with the insect, it is not without inconvenience to the vine. Certain vines appear to be injured, and the mixture of coal tar and oil can be replaced by a new mixture containing naphthaline, crude coal oil, lime, and water. The experiments at *la Paille* were continued until 1886, under the direction of M. Henneguy, and except in 1885, when, as in 1883, neither the treated nor untreated vines showed galls, the effect to the spring of 1886 was complete. What is also interesting to note, the action of the wash appears to act for a period of two years.

"At *la Paille*," says M. Henneguy, "the *Riparia* vines did not receive any treatment in the winter of 1886-7; however, I noted that on the 20th of April the vines treated in the preceding year carried but a very few galls, while the untreated vines bore very many."

After many changes in the proportions of the mixture, M. Balbiani has decided upon the following proportion for a quantity of 600 kilograms (1,320 pounds):

	Kilograms.	Pounds.
Crude coal oil .....	20	44
Raw naphthaline .....	60	132
Quicklime .....	120	264
Water .....	400	880
	600	1,320

In order to use the mixture a suitable receptacle is provided of sufficient size to hold the desired quantity. In a much smaller vessel the naphthaline is dissolved in the oil, a wooden stirrer being used. After having melted down the lime (the best obtainable) in the main receptacle, the mixture of the naphthaline and oil is turned in, and all the ingredients are ground thoroughly. All the water is not added at once, but, say, 200 liters are used at the start; 100 liters are used at the time of using the mixture, and the remaining 100 liters are used only if the mixture becomes too thick. The application to the vines is made by means of a stiff brush. All the wood is washed, the winter egg being concealed under the bark.

The different reports addressed to the Minister by Messrs. Balbiani and Henneguy contain in detail the experiments made on the experimental plots at Montpellier and elsewhere, together with particulars of the mode of application, etc. We refer the reader to the *Comptes rendus des Travaux du Service Phylloxera*, published by the Minister of Agriculture in the years 1885-86 and 1887-88, which contain the above-named reports.\*

It suffices for the writer to say that the success of the experiments at *la Paille* attracted the attention of several vigneron, who have tried the remedy; that these trials have, in most cases, been combined with the

\* HENNEGUY: *Compte rendu des Travaux du Service du Phylloxera*, 1887.

bisulphide of carbon treatment; and that the administration of Algeria employs the wash on the vines surrounding infested spots that have already been given the treatment for extinction.

According to the report of M. Henneguy (1887), about 750 hectares, distributed in eighteen departments, and 100 hectares in Algeria—altogether 850 hectares of vines—were actually treated. The French departments in which the remedy had been tried were Aude, Aveyron, Bouches-du-Rhône, Côte d'Or, Haut-Garonne, Hautes-Pyrenees, Hérault, Indre, Indre-et-Loire, Loir-et-Cher, Lot, Lot-et-Garonne, Rhône, Pyrenees-Orientales, Saxône-et-Loire, Tarn, Tarn-et-Garonne, and Var.

As said before, we cannot go into details. \* \* \* Of the entire eighteen departments mentioned above, Lot-et-Garonne (150 hectares treated) is certainly the one in which the applications are the most widespread and interesting. In this department (where M. de Laffite of Lajoannenque is an indefatigable champion of the Balbiani washes) there are numerous adherents of the theory. M. de Laffite has personally used the wash for five years on two hectares, to the exclusion of the bisulphide treatment. The two hectares are isolated, and are thus sheltered as much as possible from the apterous forms. The soil is calcareous and clayey (*argilo calcaire*) and is very compact. In 1886, according to Henneguy, an examination of the roots showed that the insects found thereon had but few tubes in the ovary, indicating a marked degeneracy; the insects were few in number; the vines were flourishing. In other experimental plots the results, though less marked, gave reason for hope of success. But in 1887, according to M. de Laffite himself,\* a study upon the experiments made with these insecticide washes solely—and even with the relatively good situation of the vineyard of Lajoannenque taken into consideration—was that “confidence in a decisive success of these insecticide washes employed alone, is sensibly less than in 1886.” \* \* \*

In spite of the theoretical excellence of the process; in spite of the experiments at *la Paille*, so clear in their results; in spite, even, of some successes attained in the vineyards, it is evident that if the insecticide washes are not accompanied by subterranean treatments with bisulphide of carbon, they are generally of little efficiency, on account of the causes which more than counterbalance their good effect. Among the first of these causes is the invasion of young aptera, coming on their legs from neighboring vineyards, or being carried by the winds, from whence no one knows. In all vineyards that are surrounded by phylloxerated vineyards, or those in which resistant vines are planted, it is useless to think of these washes. It is only in districts newly attacked or little invaded that they are of any use; and the writer advises, in conjunction, the employment of the bisulphide of carbon treatment.

\* DE LAFFITE: *Compte rendu des Travaux du Service du Phylloxera*, 1888.



## CHAPTER XVII.

## SUBMERSION.

"*Vitis amat colles*," says Virgil. This is a poetical license which the viticulturist can translate: "If thou wishest good wine, plant thy vines on the hillsides." Science and experience add: "But thou wilt get little; if thou wishest thy vines vigorous and of large production, plant them in the valleys and give them water." Naturally the European vines prefer soils that are fresh and humid, most frequently on the river banks, where they do not suffer from frequent inundation. \* \* \*

From time immemorial in the south of Russia the vine growers have inundated, voluntarily, in order to free the vines from their enemies. It is the same in Greece. \* \* \* In the struggle against phylloxera, a contest which must be varied according to location, the inundation of the vines was thought of and recourse was had to it.

"As soon as the nature of the malady was known," says M. Chauzit,\* "a resourceful viticulturist, Dr. Seigle of Nîmes, starting with the physiological knowledge that air is necessary to the life of the insect, and that it cannot live in water, inundated his vineyard at Forbarot, in Vaucluse. Dr. Seigle is incontestably the first to think of asphyxiating the insect by means of water. This was followed by a note, reproduced in the report of M. Barral, to the Immigration Congress in the Department of Vaucluse, in 1876, a note in which Dr. Seigle expresses himself as follows: From the 26th of July, 1868, \* \* \* using the water of the Durance, brought by a canal which surrounded my property, I inundated all of my vineyard for a period of twelve consecutive days, maintaining a depth of about 0.15 of a meter constantly. In October of the same year I again submerged the vineyard for twenty-eight days. In 1869 I made three submersions: One of twelve days in May, one of eight days in July, and one of twenty-eight days in October. Thus from July 26, 1868, until February 16, 1876, I had submerged my vineyard twenty times and I have obtained immunity from the pest, and my vineyard is at this time more prosperous than before the appearance of the malady."

"M. Louis Faucon did not begin to submerge his vineyard at Fabre (Bouches-du-Rhône) until 1870, as he has said in his memoirs placed before the jury at the Congress of Irrigation in 1876. But though it can be said that M. Seigle was the first to submerge his vines in France, it can be said with equal truth, and still more strongly, that M. Faucon was the inventor and propagator of the methods of submersion. In the course of many articles that appeared in agricultural journals he led the way that has been followed by submersionists; he has determined the principal rules governing submersion, and has contributed largely to the rapid extension of submersion, not only in the central portion of France, but in the West."

The figures of M. Faucon, giving the production of his vineyard before the invasion of the pest, during it, and during the time of submersion, have their own eloquence. They have become, as it were, classics, and merit being quoted. Of the vignoble of Fabre, near Tarascon (Bouches-du-Rhône), the 23 hectares belonging to M. Faucon produced:

\* CHAUZIT and TROUCHAUD-VERDIER: *La Submersion des Vignes*.

	Crop, in Hectoliters.
In 1867, before the invasion of the pest was apparent.....	925
In 1868, year of the discovery of the insect (dung manure).....	40
In 1869, second year of the invasion.....	35
In 1870, first year of submersion (no manure).....	120
In 1871, second year of submersion (no manure).....	450
In 1872, third year of submersion (rape cake).....	849
In 1873, fourth year of submersion; frost (rape cake).....	736
In 1874, fifth year of submersion (rape cake).....	1,135
In 1875, sixth year of submersion (rape cake).....	2,680
In 1876, seventh year of submersion; frost (rape cake).....	507
In 1877, eighth year of submersion (rape cake).....	2,235
In 1878, ninth year of submersion; frost (rape cake).....	1,135
In 1879, tenth year of submersion (rape cake).....	2,200

Three facts are revealed by these figures: (1) The destruction of the phylloxera; (2) The average production is more than doubled; (3) The frequency of spring frosts.

On account of the doubled production the proprietor will gain—and much—notwithstanding the loss in quality of the product, the frequent spring frosts, and the cost of installation, which is frequently large.

The example set by M. Faucon has been quickly followed in France, and to-day large tracts of land are submerged—more than 25,000 hectares in France alone. The official figures given by M. Tisserand, Director-General of Agriculture, in his report in 1888 to the Superior Phylloxera Commission, are 26,665 hectares. It can be added that if the cost were not so great, and if the necessary canals were created, these figures would be quickly quintupled. The canal of the Rhone alone, according to M. Dumont, well known in connection with one of such projects, will permit the inundation in winter of 80,000 hectares of vines.† \* \* \*

For details of the subject of submersion we refer the reader to the special works enumerated in the bibliography, and particularly to those of Messrs. Faucon, Foëx, and Chauzit, from which we will make extracts. Some directions as to the conditions necessary to success and methods of executing submersion will be made here; and this as briefly as possible in the following lines:

#### CONDITIONS OF SUCCESS.

"Submersion," says M. Foëx (page 625), "is necessarily limited to vineyards situated on the plains. On hillsides it is necessarily out of the question. Further, in cold winters, accidents are risked during the operation. Sometimes the water freezes to considerable thickness, and a change of level of the water will do serious damage.

"Up to the present time in France, submersion has not spread in the southwest and beyond in the Gironde and neighboring departments; and in the southeast it is practiced in Var, Bouches-du-Rhône, Gard, Herault, Aude, Pyrenees-Orientales, Vaucluse, Basses-Alpes, and in Drôme. In the last named department it does not go beyond Livron, situated at the mouth of the Drôme, and which can be considered as the probable northern limit of the application of the process.

"Theoretically, in order to cover land lying absolutely level to a depth of 0.25 of a meter, 2,200 cubic meters of water to the hectare would be required; but, as is understood, the earth will absorb a large part of this quantity, another portion is lost by evaporation or escapes

† FAUCON: *Instructions pratiques sur la Submersion*, page 149.

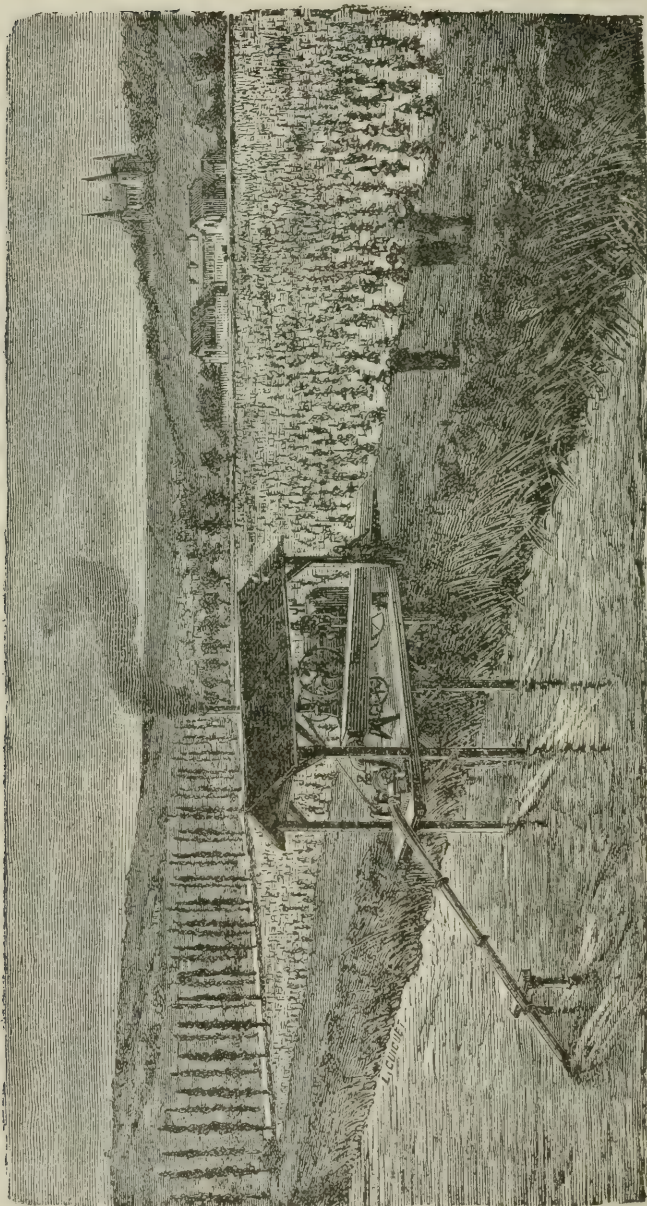


Fig. 27.  
Submersion of a vineyard located on the border of a river, by means of a Dumont pump. (According to M. G. Foëx.)



in fissures in the levees, and so much greater water supplies must be arranged for. It is usual to arrange for 10,000 to 15,000 cubic meters per hectare, and sometimes as much as 30,000 cubic meters. A portion of this must reach the vineyards nearly continuously, in order to compensate for loss by absorption and evaporation.

Considered as an insecticide, the water which contains air, such as that pumped by machinery or has passed recently through chutes, is less efficacious, because the smallest bubbles enable the phylloxera to live. Those waters in which fertilizing properties are wholly wanting will exhaust the soil somewhat of such elements, in inverse ratio as the soils which they lave are permeable.

"But all this is of secondary importance. Any fertilizing material withdrawn from permeable soil by the water can be replaced by manure and thus renewed. The following formula, recommended by M. Faucon, will meet this case:

Rape cake.....	90 per cent.
Sulphate of potash from Strassfurt, refined, and containing 38 per cent of potash.....	10 per cent.
	100 per cent.

"These well mixed should be applied at the rate of 250 grams per vine."

Though submersion is more efficient against the insect when it is in full active life—in summer—no one thinks of applying the remedy at that time; the vines would suffer too much. In winter the cessation of vegetation enables submersion to be carried out without inconvenience.

All of the hibernants do not die, it is true, but so few survive that their number is inconsiderable.

The duration of submersion is not the same in all soils and climates. Experience has shown, says Foëx, that in the northern limit in our region, in Drôme, the period can be reduced to 25 or 30 days, while it must be 30 or 40 days in Herault, Gard, and Bouches-du-Rhône. The more rapid multiplication in these warmer districts explains this.

"As to the efficiency of submersion," say Chauzit and Trouchaud-Verdier, "it is necessary that the soil be neither too compact nor light. The best condition is found when the level of the water, through the permeability of the soil, lowers from 1 to 5 centimeters every twenty-four hours. If the daily loss through this cause is 8 centimeters, the submersion will not only call for more water and require more time, but it will be less efficient; lastly, the process will be found very costly and inefficient if the water lowers 10 centimeters or more per day. This physical property, which we call permeability, results from the proportions of three elements necessary in soil: clay, silica, and lime. The more clay is present, the less the ground is permeable; and as the relative quantity of silica increases, the more easily will the water penetrate it."

The writer developed this theory in 1879, basing it on the number of air bubbles held (in the soil) in connection with the compactness of the soil.\* We added that during submersion the soil must be constantly under water to a depth of about 25 centimeters. "The water," says M. Faucon, "which would not reach the lower roots of the vine if it

\* V. MAYET: *Expériences sur l'efficacité de la submersion des vignes*. (*Journal de l'Agriculture*, de Barral, Paris, August 7, 1879.)

was applied sparingly, will penetrate to the deepest roots if it is aided by the pressure."

The choice of vines to be submerged, says M. Chauzit, is not a matter of indifference. All varieties will not stand it equally well. The Aramon and Petit Bouschet have stood it well, but as they do not mature at the same time they should be grown separately. As for other varieties, the Carignan, Grenache, Terret, Chasselas, Oeillade, Morrastel, Espar, etc., are very much subject to cryptogamic maladies, such as anthracnose and especially mildew, to be submerged safely. They should be grown, when desired, grafted on American vines.

Having given sufficiently level ground, so that the squares for submersion will have a considerable extent; having a soil in which the needful conditions as to permeability cited above are found; the operator now proceeds to divide off the vineyard into rectangular plats.

"This disposition," says M. G. Foëx, "is the easiest for work, and it is that which corresponds best to the usual mode of planting the vines. If the ground is very level, these plats can be made quite large and square. If there is a sensible slope to the vineyard it is best to make the plats rectangular, so as not to be compelled to make the levees too high. If the destruction of the insects alone is considered, the larger these

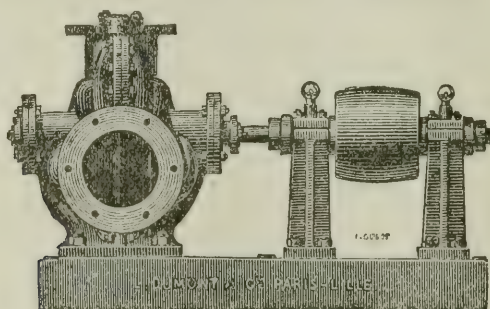


Fig. 28.

Dumont Centrifugal Pump, front view.

plats are made the better. The total length of the levees is less; and the roots which reach under the levees are rarely well purged of insects, constituting a center of infection, which it is important to diminish to the least possible point.

"But in general practice it is nearly impossible to push these principles to the extreme limit, which is to make a single submersion plot of all vines which it is desired to submerge. The four reasons which oppose this are most frequently:

"(1) The want of horizontality of the soil.

"(2) The impossibility of commanding at one time a sufficient supply of water.

"(3) The danger to the levees from shocks coming from waves raised by the wind.

"(4) The danger of counteracting the entire work, if a single break is made in the one inclosure.

"The inclosures of these plots are found in practice to be best when taking in from 3 to 20 hectares of land."

"The building of the levees inclosing the plots," says M. Chauzit, "must conform to certain rules. Thus they usually have a trapezoidal cross-section, with the sides at an angle of 45°. The size varies with the size of the plots. If these are of great extent, the levees can be of such size that hand carts can be pushed along the tops, making veritable dike roads. If the levees are more numerous, they can be from  $\frac{1}{2}$  to 1 meter in width at the top. The minimum height of the levees should be 0.65 meters; but in practice they usually run from 0.8 to 1 meter. The earth for these levees can be obtained by leveling higher spots."

In order to protect the sides of these levees they can be planted with forage plants. M. Foëx advises clover (*Trifolium repens*), which easily bears humidity or dryness; but until the plants are well established—at least in the first year—it is desirable to protect the slopes exposed to the action of the water with vine canes, or reeds, or fascines.

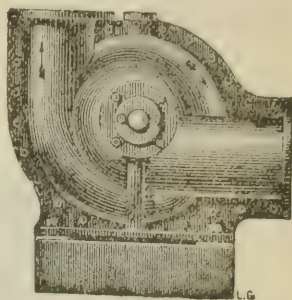


Fig. 29.  
Dumont Centrifugal Pump, side  
view.

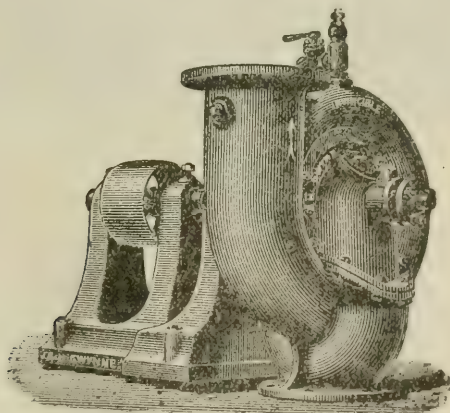


Fig. 30.  
J. & H. Gwynne's Centrifugal Pump.

Once the levees and submersion plots are established, the question of water supply at the least cost becomes important.

"The water for submersion can come from watercourses, canals, ponds, springs, artesian wells, etc.," says Mr. Foëx. "It can be turned on the vines by a system of canals (gravity), or by means of pumping machinery."

The first of these methods is the simplest and cheapest, and should always be employed where the water supply has a higher level than the vines; it requires no other expense than the cost of making suitable canals. Unfortunately, recourse cannot be had in all cases to this method, and the second system must be employed. The most generally used lifting machines are rotary pumps.



The pumps that are most widely used in France are those of L. Dumont (Figs. 28 and 29) and of J. & H. Gwynne (Fig. 30). These latter constructors have devised a system for transporting the pump as desired, in which the pump is attached to a movable engine. (See Fig. 31.)

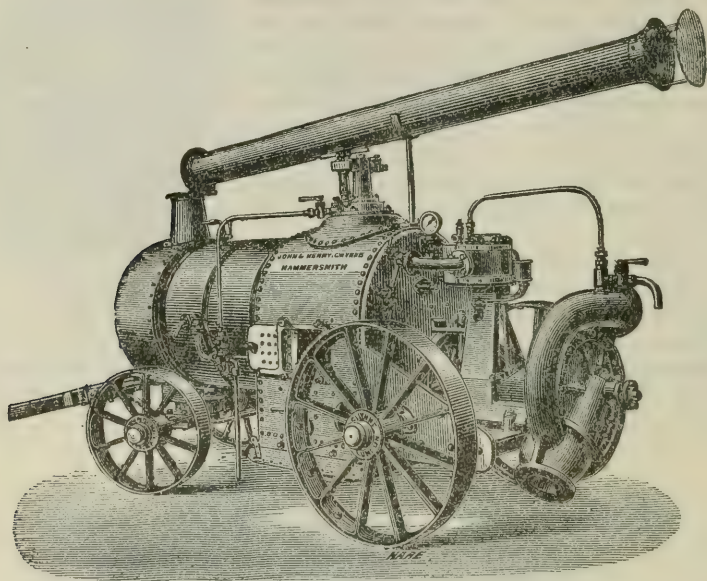


Fig. 31.

Centrifugal Pump of Gwynne attached to an engine.

Other machinery that will develop power can be employed, but the steam pumps will generally be found more desirable.

The different pumps mentioned here are usually operated by steam power; such power will generally be found the most easy to utilize. The cost of working by this means generally runs from 60 to 80 francs per hectare. This price is generally what is asked by the syndicates or societies.

The machinery is sometimes set up permanently on a commanding point, so as to reach by a system of canals the land to be submerged. Sometimes the machinery is movable, and is moved from place to place as desired.

The first system (immovable) should always be preferred where it can be applied. The work proceeds better and more rapidly than when the apparatus is moved about.

It is possible in special cases to utilize the power of a watercourse for driving the machinery. In such cases turbines or water wheels are used. Under such conditions submersion is very economical.

In conclusion, submersion is the only infallible insecticide process against the phylloxera, and it should be employed, every time, wherever possible.

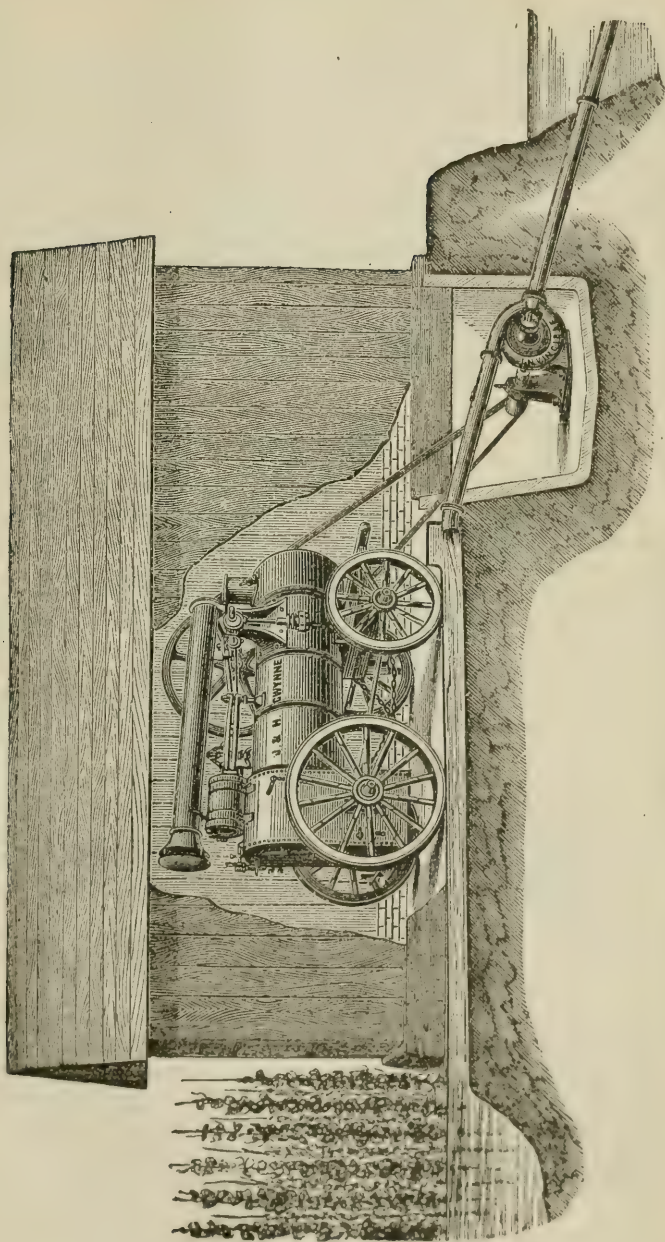


Fig. 32.  
Movable Installation of a Gwynne pump at the border of a river. (According to M. G. Föck.)

## CHAPTER XVIII.

## PLANTING IN SANDY SOIL.

There remains for us to speak of the conditions under which European vines can live without any insecticide treatment; that is to say, in sandy soil, and by the use of American vines. When the phylloxera began its invasion the fact that vines still live in sandy soil attracted the attention of viticulturists. They did not agree, however, as to the causes of this immunity, and many theories are in evidence. We will cite but three:

(1) A mechanical action of the sand filling all fissures in the soil, slipping under the feet of the insect, and offering thus a barrier to their migration from vine to vine, and even to their circulation on the roots. This theory has many partisans.

(2) An insecticide action, badly defined, which cannot be called chemical, but which, according to Professor Marion, is incontestable, whatever be the explanation.\*

(3) A physical disposition of the soil, which enables it to throw off the air which it contains and at the same time to be penetrated by water coming from rain, or which comes up from the subsoil by capillary action, thus killing the phylloxera by asphyxiation. This theory appears to be proved by experiment, and was developed at length by the ingenious M. Vannuccini in a memoir published in 1888.†

"In sandy soil," says M. Vannuccini, "when water comes on the soil, it goes between the innumerable interstices between the grains of sand, and as soon as a bubble of air is surrounded by water it forces its way to the surface. The following experiment will prove this: Take two vessels, one containing sand, the other clay. On pouring water into the one containing sand many air bubbles will come to the surface, while if water is poured into the vase of clay but few will come up. Between these two extremes are sandy clay soils which are easily penetrated by water and only a few bubbles of air remain when they are soaked. Thus it is that the gradation of resistance of vines in various soils can be accounted for. It can be seen that in pure sand the vines would be perfectly resistant, and as the proportion of clay in the soil increases the resistance is diminished until the vines die in soils that contain much clay."

The author compares this action to a natural submersion produced every year at certain periods, and freeing the vines periodically of the insects. \* \* \*

This theory of M. Vannuccini has not yet been refuted by any one. It is not contradicted by the ideas of M. Marion, or of M. Barral, who, in a note to the Academy, has attributed an important rôle to the water in the subsoil rising by capillarity in the sandy soils of Aigues Mortes.‡

The more silica in the soil the more will the phylloxera be resisted. If the proportions of lime dominate, the resistance is less, as the calcareous properties tend to agglomerate. Such soils are those known geologically as the sandy soils of Montpellier (old Tertiary dunes), which

\* MARION: *Rapport sur les expériences contre le phylloxera et les résultats obtenus*, Campagne de 1878. Paris, Paul Dumont, 1879.

† VANNUCCINI: *Etude des terres où la Vigne indigène résiste au phylloxera*. (Mess. Agric. du Midi, September 10, 1881.)

‡ J. A. BARRAL: *Influence de l'humidité souterraine et de capillarité du sol sur la Végétation des Vignes*. (Comptes rendus, February 12, 1883.)



contain a notable proportion of marl and shell debris mixed in them. If the sand contains salt it is harmful to the vine.\*

"Except in low and salty lands, the vine appears to prosper in all land where the proportion of silica in the soil exceeds 60 per cent. The vine succeeds in the sand dunes of Gascony, the sea coast bordering the gulf of Lyons—notably at Aigues Mortes—and in the sea coast sands of Tunis and Algeria; finally, the vine succeeds in the alluvial sands of the valley of the Rhone and of other watercourses.

"All of the sandy soils in the vicinity of Aigues Mortes, now planted in vines, were formerly planted to madder; that is to say, they were the richest and worked the longest, and on them the best results as to quantity are obtained. Sometimes as much as 250 hectoliters of wine per hectare is obtained from these soils.

"The soil must be worked thoroughly by the plow following a sub-soiler. The Aramon, Petit Bouschet, Cinsaut, Chasselas, and particularly the Piquepoule succeed best in sandy soils, provided they be properly manured. Farm manure has been used, but chemical manures are best."

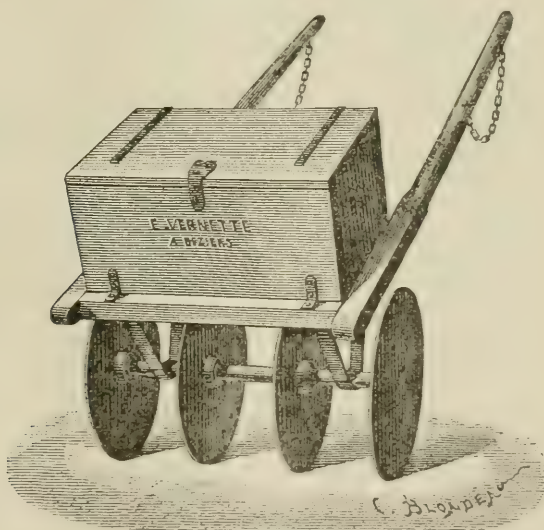


Fig. 33.

Apparatus of M. Vernet of Beziers for enjonçage.

The writer has spoken of the advantages of having a sandy soil. There are also inconveniences and drawbacks. Sand is easily moved by the wind, and certain vines will be laid bare and others covered up by sand dunes. This drawback can be met by covering the soil (*enjonçage*).

"The operation," says M. G. Foëx, "consists in covering the sand with rushes or other marsh plants, which are worked into the soil by means of a share or a machine carrying several iron disks." (See Fig. 33.)

The small quantity of rushes that will grow in the sand can be removed by hoeing. \* \* \*

\* Common salt (chloride of sodium), which is valuable in small quantities as a fertilizer on soils in which it is wholly absent, sterilizes the soil if it is in excess. \* \* \* The vines should be planted in spots sufficiently sandy and sufficiently above the level of the sea that the salt will not come up through the soil by capillarity.

## CHAPTER XIX.

## EMPLOYMENT OF AMERICAN VINES.

The vast and complex question of American vines (resistance, adaptation, grafting, etc.) which has given rise to so much controversy and has blackened (used up) nearly as much paper as the question of insecticides, is not to-day completely elucidated, but is entering on a period of calm and study, both theoretical and practical.

*History.*—"American vines were known earlier by the Europeans than is generally thought.\* In the tenth century they already attracted the attention of the hardy navigators who preceded Christopher Columbus in the discovery of America. Christian Rafn, a Danish archæologist, who has collected a large number of documents on the voyages made by the Scandinavians from the tenth to the fourteenth century to the eastern shores of America, says that in the year 1000, Leif, the son of Eric the Red, left Greenland with thirty-five men to explore more completely the land visited by Bjarne (Bjorn) in 986. He landed in Massachusetts, and a German named Tyrker discovered grapes, with which he supplied the boat. Since then many voyages were made, and Leif called the country Vinland.

"Adam de Brene (12th century) stated that the vine flourished in America; he knew it, he said, not by conjecture, but by the authentic accounts of the Danish. He gave as authority the Danish King Svein Etridson, nephew of Canute the Great."

The first attempts to cultivate the American vines by the European colonists were made in Florida, according to Bush and Meissner.† The same authors say: "The French colonists of Illinois, near Kaskaskia, made, in 1769, with the grapes from wild vines, one hundred and ten casks of heavy wine; but the quality, judged bad, made them decide that the European vine was the true wine-producing vine. In 1630, The London Company sent French vineyardists to Virginia to plant vines sent to the colony for that purpose, but the checks encountered then (and since by William Penn in 1633, by the Swiss colonists in 1690, and at the close of the last century by Lakanal in Kentucky, Ohio, and Alabama), compelled the European colonists to abandon the effort. In the nineteenth century there have been a thousand similar failures, and not a single passable success; and Downing was perfectly correct in writing (*Horticulturist*, January, 1851): 'The introduction of European vines into America for cultivation on a large scale is impossible. There is first a season or two of promise and then a complete failure.' It is necessary always to except California, which to-day is the principal producer of wine in the United States, and all these remarks on the cultivation of European vines refer solely to the States east of the Rocky Mountains.‡ While the facts cannot be denied, the cause remains a

\* G. FOEX and P. VIALA: *Ampelographie Americaine*, Montpellier, Coulet, page 1.

† BUSH and MEISSNER: *Les Vignes Americaines, catalogue illustré et descriptif*. (Translated from the English by L. Bazille, reviewed and annotated by J. E. Planchon. Montpellier, Coulet, 1876, and 2d edition, 1885.)

‡ The constant failure of the European vines in America is one of the best arguments in favor of the American origin of the phylloxera, which was so long disputed. Though in California the European vine (Mission vine) has been cultivated for a long time, it was preserved from the phylloxera by the then impassable barrier of the Rocky Mountains, the phylloxera originating in the Atlantic basin. To-day the insect has cleared this barrier through the creation and ease of communications, and the European vines in California succumb to the insect, the same as do the vines in Europe.

mystery—a mystery which the discovery of the phylloxera and its work has since (Downing's time) explained. The Americans were thus forced to return to their indigenous varieties.

"The *Vitis labrusca* (G. Foëx and P. Viala) were found to give the largest crops, and it was with these that the first efforts were made. The active and persistent cultivators created a large number of varieties of this species. Soon afterward attention was drawn to the *Vitis riparia* and the *Vitis æstivalis*, and in the South to the *Vitis rotundifolia*. Then they sought to obtain, by means of hybridization, between the different species, or between one of them and European vines, new intermediate varieties, which to-day have an important position in American viticulture. Mr. Longworth, of Ohio, may be considered as the first to take up the cultivation of these wild vines, beginning about 1823. He has been followed by many well known in the United States, such as Underhill, Roger, Arnold, Adlum, Bull, Reckett, etc.

"The American varieties remained little known in Europe for a long time, owing to their inferiority for the table and for wine making. When such varieties as the York-Madeira and the Isabella were brought out their ornamental qualities were recognized, and the vines adopted for arbors, etc. It was not until 1861 that the Marquis de Ridolfi undertook, in order to escape from the ravages of oidium, to cultivate the Isabella on a considerable scale in his properties near Florence."

According to M. Planchon (*Revue des Deux Mondes*, 1877), the Catawba and Isabella were introduced in 1825; but the first rooted plants were taken to Europe in the years from 1858 to 1862. "By a singular coincidence," says he, "these introductions were made about the same time at different sections and countries of Europe—at Bordeaux, Roque Maure, England, Ireland, Alsace, Germany, Portugal."

M. Laliman, of Bordeaux, was the first to notice and announce, in 1869, the resistance of the vines of the New World. (Congrès de Beaune.) Mr. Riley affirmed this in 1870, especially as to the variety commonly known in the United States as the summer grape (*Vitis æstivalis*).

The first who thought of grafting was M. Gaston Bazille, President of the Agricultural Society of Herault. In 1869 he tried unsuccessfully to graft French vines on their American cousins. In 1871, having received some American canes, he succeeded in making them take on French vines,\* and in the following year grafted French vines on American stocks. At the same time Messrs. Planchon and Lichtenstein succeeded in the same particular in their experimental fields.

In 1872, M. Victor Lefranc, Minister of Agriculture, imported, through the French Consul at New York, a quantity of American vines, selected by Mr. Riley, and which were distributed in Herault through the President of the Agricultural Society. In 1873 the resistance of American vines becoming more and more apparent, M. Planchon was sent by the Government to America to study these vines in their native country. From the time of the return of the learned professor, the movement spread rapidly, particularly at Montpellier, where the zeal and work of savants and practical men multiplied experiments. At two important experimental stations (the collection of vines of the National School of Agriculture at Montpellier, and the Departmental Phylloxera Commission—presided over by M. Henri Marés) permitted the examination of a

\*G. BAZILLE: *Messageur Agr. du Midi*, July, 1871.



great variety of vines. The collection of the National School, started by G. Foëx, contained, alone, about two hundred and thirty varieties of American vines. It is only just to associate with the names of the active workers mentioned above, that of the Director of the School, who, by his remarkable works, has taken rank as one of the first ampelographers of the time.

The viticulturists and savants of the Gironde followed in the movement. The example of M. Laliman was followed by a large number of vigneron, and M. Millardet undertook his experiments on hybridizing the American varieties with the vines of Europe.\*

To-day, after many efforts, and in spite of the struggles, in spite of vexations, and in spite of drawbacks attending an absolutely new mode of culture, and using plants from extreme latitudes, the partisans of the use of American roots have triumphed in nearly every locality that has been badly attacked by the insect.

Of the three great questions—resistance, grafting, and adaptation—the first two have been absolutely settled. We have some vines twenty years of age grafted on such resistant stocks, and thousands of hectares of vines that have been grafted ten or fifteen years, to attest this success. The total number of hectares of reconstituted vineyards at the end of 1887 (see *La situation phylloxérique en 1887-1888*, by M. Tisserand), was 166,517. The American vine, in spite of its detractors, has proved its own case.

Among the many botanical species native to America, and belonging to the order of *Vitis*, the four following have been used in Europe on a large scale: *Vitis æstivalis*, *Vitis riparia*, *Vitis rupestris*, and *Vitis labrusca*.

Of the varieties most widely known of these species may be mentioned: Of *Vitis æstivalis*, the Jacquez, Herbemont, Black July, and Cunningham; of *Vitis riparia*, the wild Riparia, Solonis, Clinton, Taylor, Vialla, and Franklin; of *Vitis rupestris*, the different varieties of the wild *Rupestris*; of *Vitis labrusca*, the Concord, York-Madeira, and Isabella. Of late there have been used three other wild vines—the *Vitis cordifolia*, *Vitis Berlandieri*, and *Vitis cinerea*.

If there are still questions to be solved by those in favor of American vines, it is that the adaptation of different stocks to different soils is still open. The recent mission to America, undertaken by M. Pierre Viala for the French Government—a mission at the same time geological as well as botanical—will assist, we think, in solving this problem; but before attacking this subject we will say some words on resistance and the reasons for it.

Of grafting we will say little, referring the reader to the many works published on this vast subject. \* \* \*

*Resistance.*—Considering this subject as a whole, and from the view of an observer, it can be said that ninety-nine times in a hundred a vine that is resistant in its country of origin will be found resistant in Europe. Have any cases been noted where an animal or vegetable species, transported from its native country, will succumb to natural parasites imported with it, parasites to resist which it is adapted? Ordinarily when any exotic species succumbs with us, it is when it meets conditions of soil or

\* These experiments, it is said, will enable the viticulturists to plant *direct producers* resistant to the phylloxera, where ordinary wine only is wanted, and will do away with the necessity of grafting.

climate to which it is not adapted, or when it meets new parasites. American vines, which grow in about the same latitude in their native country as the latitude in which vine growing is carried on in Europe, and in soils that are comparable, are found to resist the phylloxera, not finding new parasites to destroy them, and they therefore have every opportunity of prospering in Europe.

However, what are the causes of resistance? On this question we will quote from an author from whom we have already freely borrowed: "It was thought at first," says M. Foëx, "that the resistance of American vines was due to their vigor and ease with which they threw out new



Fig. 34.

Cross-section of a root of the Aramon (*Vitis vinifera*), non-resistant; enlarged 20 times. (According to G. Foëx.)

roots to replace those destroyed, and this faster than the insects could multiply in order to destroy the roots. This is an error. Decisive proof of this is obtained by a comparative examination of certain American and French types. The York-Madeira, for example, which is an American hybrid, has only a moderate growth and still resists very well, while the Aramon, of Languedoc, which is a remarkably vigorous grower, succumbs to its attacks. Another hypothesis was evolved by M. Boutin in 1876. This chemist thought that resistance of the American vines was due to the presence in the root of plastic matter, to which he gave the name of 'resinoidal matter,' a substance which opposed the loss of sap following the attack of the insect. This theory was founded on an incorrect conception of the phenomena following the insect's attack.

"There is, as a matter of fact, no loss of liquid from such cause. Furthermore, analyses at the School of Agriculture, at Montpellier, show that the degree of resistance is not proportional to the resinoid matter in the roots. We think that the reason must be sought elsewhere.

"The lesions produced by the phylloxera take on size according to circumstances. When the young rootlets do not have a woody body well organized, the swellings take on a considerable size and alter completely

the structure of the rootlet, ending in the death of the rootlet. When, however, the central cylinder of the root is woody the swelling grows to a size according to the thickness of the cellular tissues of the bark and according to their density. A very sensible difference is also shown in the extent of the changes in the roots of the *Vitis vinifera* as compared with the *Vitis riparia*, *Vitis æstivalis*, *Vitis rupestris*, etc. In short, with the *V. vinifera* the alterations reach all the different cellular tissues of the root, while with the varieties named the cortical coating alone is attacked.

The consequence of the penetration of the effects of the attack to the medullary rays (in the *V. vinifera*) is, after many attacks, the alteration of all the cellular tissues and the final destruction of the root. With the resistant vines the alteration of the root is but superficial, the wound cicatrizes and the root itself throws off the scar which results. \* \* \*



Fig. 35.

Cross-section of root of Jacquez (*Vitis æstivalis*), resistant; enlarged 20 times. (According to G. Foëx.)

"The different varieties of the *Vitis labrusca* appear, in general, to be intermediate, from the point of view of these lesions and the conservation of the roots, between the two conditions we have established.\*

These differences can be rationally explained by observing the corresponding differences in the structure of the tissue of the roots of various species. If roots of the same age, but of different species, are examined, it will be noticed that the roots of the American vines are more lignified. The bark is thinner and denser, the cellules in the root are smaller, the medullary rays are closer and more numerous, and the diameter is smaller than in the roots of European vines (see Figs. 34, 35, and 36).

\* According to Millardet (*Les Vignes Américaines résistant du Phylloxera*), the property of resistance is at the maximum, and gives immunity from the pest, in the following species: *Vitis rotundifolia*, *rubra*, *cordifolia*, *rupestris*, *riparia*, *cinerea*, and *æstivalis*. It is more or less weak with the *Vitis candicans*, *californica*, and *labrusca*. It is nothing with the *Vitis vinifera* and *amurensis*, and also in all Asiatic species hitherto known.





Fig. 36.

Cross-section of a root of the Solonis (*Vitis riparia*),  
resistant; increased 20 times in size.

*Adaptation to the Soil.*—We have heretofore stated that the only points unsolved as to American vines related to their adaptation to the soil. We have expected the vines to succeed in soils not suited to their growth (in chemical composition), or not suited from physical conditions, and numerous disappointments have been encountered in consequence. It is as though we wanted trees to succeed in a marly soil, when they were suited to a sandy soil—such as the chestnut and cork oak.

Professor Viala's mission to America, which resulted in the collection of many specimens of vines and soils, gave us, above all, much valuable information on this question. Professor Viala has seen and seen well. Vines, such as the *Vitis Berlandieri*, the *Vitis cinerea*, and the *Vitis cordifolia*, have been seen growing vigorously in marly and chalky soils as well as in white soils like those of the Charentes, the Champagne, and certain regions of the middle of France. There is no reason to think that those vines which succeed in America will not succeed in Europe. The problems will be settled by experiments under way.

As concerns the adaptation of American vines to different soils, these can be grouped as follows, according to Foëx:

- (1) Deep soils, fertile and cool: Wild Riparia, Jacquez, Solonis, Vialla, and Taylor.
- (2) Deep soils, rather heavy, not humid: Wild Riparia, Solonis, Vialla, Taylor, Othello, and Jacquez.
- (3) Deep soils, moderately heavy, cool in summer: Wild Riparia, Jacquez, Solonis, Vialla, Taylor, Black July, and Othello.
- (4) Light soils, pebbly, deep, well drained, not too dry in summer: Jacquez, Vialla, Wild Riparia, Taylor, Rupestris.
- (5) White calcareous soils, chalky, marly, or tufaceous (travertines): *Vitis Berlandieri*, *Vitis cinerea*, and *Vitis cordifolia*.
- (6) Gray clayey soils: Jacquez.
- (7) Deep and very wet clay soils: *Vitis cinerea*, and Solonis.
- (8) Deep sandy soils and rather fertile: Solonis, Jacquez, Black July, Rupestris.

(9) Dry, flinty, pebbly soils, arid, called the *garrigues*: *Rupestris*, Wild *Riparia*, *Gloire de Montpellier*, *Grande*, *Glabre*, etc.

(10) Deep soils, overlying tufa (travertine), and soils a trifle salty: *Solonis*.

(11) Soils colored red by iron peroxide, with silicious rocks (diluvium alpine), deep, and a little strong: All the varieties named above.

The American vines which succeed best in the olive-growing sections of France are: Wild *Riparia*, *Solonis*, Taylor, *Rupestris*, Jacquez, Cunningham, York-Madeira, and sometimes *Herbemont* and *Vialla*.

In the southwest the types preferred are: *Vialla*, York-Madeira, *Solonis*, Wild *Riparia*, *Rupestris*, *Herbemont*, *Othello*, Canada, and Noah.

In Savoy, Isere, Beaujolais, and Burgundy, good results have been obtained with *Vialla*, York-Madeira, Wild *Riparia*, Noah, Canada, *Othello*, *Senasqua*, *Eumelan*, and *Cynthiana*.

The principal direct producers are: *Vitis æstivalis*—Jacquez, Saint-Sauveur, *Herbemont*, *Herbemont d'Aurelles*, Black July, *Eumelan*, and *Cynthiana*; and among the hybrids, the Canada, Brant, *Cornucopia*, *Othello*, and Black Defiance.

The grafting stocks most employed are the Wild *Riparia*, Jacquez, *Vialla*, Taylor, York-Madeira, and *Rupestris*.

Such, described as briefly as possible, are the different methods used against the phylloxera. Placing aside the questions of submersion and of the effect of sandy soil, we will now state what should be done if the insect appears in vineyards neither capable of submersion nor on sandy soils. This is equivalent to saying what should be done in most cases:

*First*—If there are but few known points of attack, destroy these points by the "treatment for extinction," using bisulphide of carbon.

*Second*—Once the vineyards are affected to a considerable extent, but will produce profitably, cease the "extinction treatment" (which kills the vines), and apply the bisulphide of carbon remedy; and in case the attacked vineyards are isolated sufficiently, the Balbiani lime washes can be added.

*Third*—If the vines do not yield enough to meet the cost of treatment, pull them out and substitute them by American grafting stocks suited to the nature of the ground.

By proceeding as above, a goodly number of proprietors of Herault and especially of Aude, have maintained their yield of wine to the figures before the invasion of the phylloxera.

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If the writer dreamed of publishing such a work to-day, the material would fill an enormous volume of doubtful utility. \* \* \* It will be

sufficient, we think, to give some pages of references from which useful information can be drawn. In order to "separate the wheat from the chaff" we will draw from five principal sources:

- (1) Comptes rendus Académie des Sciences de Paris.
- (2) Faits acquis et Revue bibliographique (1872), by J. E. Planchon and J. Lichtenstein.
- (3) Littérature générale oenologie, by E. Wagenmann. (Annal der oenologie, Heidelberg, 1880.)
- (4) Monographie du Phylloxera, by E. Delamotte. (Alger, 1885.) A work in which about forty pages are given to bibliography.
- (5) Notes bibliographique sur le Phylloxera of the Cours Complet de Viticulture, by G. Foëx.

We will adopt the same plan of division of the questions as in the last named work.

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APPENDIX E.

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POSSIBLE TRADE IN MEXICO.

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## POSSIBLE TRADE IN MEXICO.

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SAN FRANCISCO, September 1, 1894.

*To the Board of State Viticultural Commissioners:*

GENTLEMEN: Under instructions from your Executive Committee to investigate the possible market for wines and brandies in Mexico, I beg leave to submit the following reported interview with Mr. W. J. Parker, of the Mexican Central Railway, together with other statistics furnished by him.

WINFIELD SCOTT,  
Secretary.

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### INTERVIEW WITH W. J. PARKER.

MR. SCOTT: Mr. Parker, I understand that you are the agent of the Mexican Central Railway, and that your business here is to devise some means of obtaining a market for California products, and particularly wines, in the central and eastern portions of Mexico?

MR. PARKER: Yes, sir; that is correct.

Q. Has any effort yet been made by California shippers to develop this market? A. No well-developed effort has been made. From time to time California firms have, by correspondence and by traveling men, tried to sell wines in Mexico, but as they have taken no pains to study their trade or its demands in an intelligent manner, they have failed to be successful. To explain, I will say that the manner of conducting business in Mexico is different from what it is here, and to be successful you must, to a very great extent, conform to the manners and customs of the country in doing business with its merchants. To attempt to hurry the merchant in his buying is a wrong move. To be successful, study the people, their manners and methods, and then conform to them. Identifying yourself with them and with their interests. Lack of doing this is the reason that Americans have not been successful in conducting business in Mexico heretofore, and by doing this the French and German element have held the trade. Since the advent of the railways the manners and customs of the country have been undergoing a change for the better.

Q. What firms have been engaged, so far, in developing this? A. Gundlach & Co., Carpy & Co., the Wine Growers' Union, B. Frapolli, and others.

Q. Give us a history of what has been done, so far as you are able. A. I do not know that I can give you a very correct history. Last year I was sent up here by the Railway Company to look over the situation. Through the newspapers the matter was made quite public, and immediately following my visit here the California Wine Growers' Union were the first to take the matter up, and sent a man down there. Other

companies have had men down there, but they have never worked the country systematically. They send a man down there, and he will visit a few of the best towns and probably sell a bill of goods. Some men have gone down there who have sold nothing. That was more the fault of the man that was sent than the goods.

Q. What is the character of the trade down there? In asking this question I mean, do the higher class of goods take well, or the wines of a lower grade? A. I would say that the better class of goods would pay best, and when introduced would take better. So far as I know, the wines sold there have been in price from 65 cents a gallon up. That, of course, does not include the freight—simply 65 cents f. o. b. at San Francisco—and the rate of freight would be \$1 25, U. S. coin, for carload lots, and \$1 52 for less than carload lots to all common points.

Q. How many common car points are there? A. There are six—Pachuca, City of Mexico, San Luis Potosi, Puebla, Lerdo, and Torreon, Mexico. We could make this same rate to any point.

Q. And this rate would include from any common California shipping point? A. From all California terminals and points intermediate thereto.

Q. What is the duty on wine in Mexico? A. Duties on wine, red or white, in barrels or kegs, 10 cents a kilo, gross. The same in bottles, 20 cents a kilo, net.

Q. And what is the duty on brandy? A. 30 cents in kegs and 50 cents in bottles or jars, net.

Q. In answering the question as to the quality of wine that would take in Mexico, would you advise dealing through a commission house in Mexico, or would you advise establishing a central depository in the City of Mexico and making that a point of distribution? A. The latter, I should say.

Q. How would you advise establishing such a depot? A. I should say that the best way would be for a number of the producers of the representative wines to select some one of their number, or some one interested in the wine industry of the State, and send him to Mexico, first, to look over the field carefully, and then, if decided best, to establish a wine depot, such as you mention, in the City of Mexico; and that these producers furnish their stock in carload lots, giving such wines as they could furnish at all times—in other words, establish a reputation for certain brands of wines. If those wines are placed there in a depository of that kind, with some one in charge who has an interest in the business, I am quite sure that the result would be much better than by sending traveling men. You know very well that if you send a traveling man out on a salary he does not do the work that a man would who has an interest in the business. It is a matter of dollars and cents to a man who has his own stock in the business, more so than to a traveling man who is working on a salary. From the City of Mexico, which is a central distributing point for the whole country, you can reach out to all the outlying towns for hundreds of miles. Everything in the business line of the Republic of Mexico is virtually based on what is said and done in the City of Mexico—in other words, that is the governing market of the whole country. All prices and freight rates are made with reference to the trade of Mexico City. Never sell one class of wine and deliver another; or, in other words, if you sell a certain grade by sample, see that the goods delivered are up to the sample in every particu-



lar. Carry out instructions from the buyer to the letter. Some may seem ridiculous, or behind the times, but it is not for the shipper or seller to determine this. Watch the shipping clerks, and see that they do not shirk or assume responsibilities.

Q. About how large a stock of wines would you think would be necessary to start the depot in the city? A. That I am unable to say.

Q. It would depend largely on the quickness of transportation from California, would it not? A. Yes, sir; and that can be made at the present time very quickly, and, so far as we are concerned, we should take special pains to furnish any shipments of that kind in carload lots quick transit, and I do not think it advisable for you to move goods in any less than carload lots on a proposition of that kind. Of course, if you could make a sale somewhere in the country of less than a carload lot, we would give the matter the utmost dispatch possible, but naturally carload lots take the preference.

Q. What is the average time for the transportation of freight to the City of Mexico? A. From six to ten days from California terminals.

Q. From what you have said of the trade in the central and eastern portions of the country, what character of wines are they now drinking?

A. The wines drank in Mexico have heretofore come mostly from France, and, so far as I am capable of judging of the common table wines, I do not think they are in any way equal to the California wines. The red wine, *vino tinto*, as it is called, is mostly used on the table.

Q. Is it a light or a heavy wine? A. I should say it was rather light.

Q. The demand for white and fortified wines is very small there, then? A. The white and fortified wines are in better demand among the upper class, who have more education upon the subject and are better qualified to discriminate between the qualities of red and white wines.

Q. It is the middle class, then, who drink most of the red wines? A. Yes, sir.

Q. Have you any idea of the volume of foreign wines shipped into Mexico? A. At the present time not any. I asked our General Freight Department for figures on the subject.

Q. I think I saw some figures in the report of the Bureau of the American Republics that it amounted to something like \$800,000 a year? A. That I am unable to say. The statistics will have to be obtained from the State Department of Mexico.

Q. How about the credits of the country? For instance, if a man would sell wine from his central depot in Mexico to various dealers or wine handlers in other cities, what credit would he have to extend to the purchasers? A. Well, that would depend largely on the firm. Some firms do a cash business; others give as much as four months' time. In that matter you would have to have a man there who could discriminate in these matters and see the best way of handling them. The merchants heretofore, in buying wines in France and other foreign countries when goods were bought on long time, were used to getting from four to six months' credit. That has been the custom of the country, and I think that from three to four months' credit has been the usual rule, when it is not paid in thirty days. Terms on United States goods sold in Mexico are many times *spot cash*. The dealer very often has an agent or correspondent in New York, or in whatever city he may be trading with, and these agents are usually a commission or forwarding firm, to whom he directs the goods to be delivered, and the latter pays the bills, deducting

an allowance of  $2\frac{1}{2}$  to 5 per cent commission. The establishment of a wine depot would save the merchant this commission, and be an inducement for him to buy his goods of such a depot. Failure among the better class of merchants is of rare occurrence, and in their dealings they are fair and honorable.

Q. What chance would California wine have to compete with the French production? In this connection what freight rate do the French pay on red wines, for instance, from Bordeaux to the City of Mexico?

A. I am unable to say what the through rate is. The rate from Vera Cruz to the City of Mexico is \$33 15 for one thousand kilos. This \$33 15, of course, is in Mexican money. The premium at the present time is 95 per cent.

Q. And what number of people would be served with wine from the City of Mexico as a distributing center? A. The population of Monterey is 40,000; Saltillo, 25,000; San Luis Potosi, 40,000; Morelia, 30,000; Toluca, 15,000; Mexico City, 350,000; Jalapa, 15,000; Orizaba, 10,000; Puebla, possibly 100,000; Pachuca, 25,000; Oaxaca, 30,000; Juarez, 15,000; Chihuahua, 20,000; Lerdo, 10,000; Durango, 30,000; Zacatecas, 50,000; Agua Calientes, 35,000; Irapuato, 5,000; Celaya, 5,000; Leon, 70,000; Guanajuato, 60,000; Guadalupe, 100,000; Queretaro, 35,000; Tampico, 10,000. In addition to these there are Jimenez, 5,000; Fresnillo, 5,000; Lagos, 20,000; Siloam, 15,000.

Q. What percentage of the total population would you estimate lives on the central plateau, and is directly tributary to the city by rail connection? A. You might say all that I have mentioned.

Q. What percentage of the total population of the country? A. That I cannot tell you.

Q. Sixty per cent? A. All of that, I should say, live in those towns, or are supplied by merchants who are doing business in these various cities with branches in the interior towns.

Q. Now, as to the character of the people—are they wine-drinking people or a brandy-drinking people? A. Both. They drink a great deal of cognac. The better class of them are great drinkers of wine. They drink *vino tinto* and the heavier Spanish wines.

Q. Is there any prejudice in the country against American productions? A. No, sir. Among the better class of Mexicans, American productions of all kinds are taking well. There are many reasons for this, the principal one being that they can obtain their supply by rail quicker than they can by vessels, and while a few years ago nearly everything came from Europe, the balance of the trade at the present time is largely in favor of the United States, in all its branches. For this reason, a merchant carrying a hundred thousand dollars of stock can carry a larger assortment if bought in the United States than by buying in Europe. It takes from four to six months to give an order and get the goods in the store from Europe, whereas, in the United States they can order by telegram, if necessary, in such quantities as they may need for their actual trade, and have fresh goods on the way at once. They see the advantage of this, and avail themselves of it readily.

Q. Now, as to climate. In the central portions of Mexico, do you think that, from your experience with the average temperature there, there would be the same difficulty that California shippers experience in shipping to hot climates, like New Orleans, for instance? A. The average temperature of the City of Mexico is  $62^{\circ}$ . In some portions of

the interior the average temperature may go as high as 65°, or possibly 70°, the year round.

Q. What facilities are there for cellars in the City of Mexico, for instance? A. There are no cellars.

Q. How would the wine be stored? A. The buildings in the City of Mexico are of adobe or stone, with very thick walls, making the interior very cool and the temperature very equal.

Q. And rents? A. The rents are lower in proportion, I should say, than in San Francisco.

Q. And the cost of labor for handling wines? A. Is very low.

Q. How would you advise handling wine that has been sent to the depot? Would you think it would be best to sell it under the brand of the California producer or under the brand of the buyer who might purchase his stock from the central depot? A. I should say if possible handle it under the name of the producer. If this is not possible, and the buyer wishes to appear as an importer of California wines, give them the label as California wines imported by whoever the buyer may be.

Q. How much wine was shipped into this section referred to last year over your line? A. The wines from California to various points in Mexico was 276,860 pounds.

Q. Now, Mr. Parker, are there any other points of interest you may have omitted that you may think of that will be of value to us? A. At the present time I should say no. I have written to Mexico for data concerning the importation of wines from Europe and some other general information, and as soon as I receive it I will submit it to you, but that will be a week or ten days. As an additional suggestion I would say that, knowing the habits of the people, I am sure it would do well to place a café in connection with a wine depot, where nothing but California wines were served to the customers under *no* other brand than California wines, and at a purely nominal price, simply enough to cover the cost of production and handling, and to be served in such manner as to give business men a chance to see and sample the wines and at the same time to allow them to have the privacy necessary to conduct little business transactions, or to meet their friends. Such cafés are a common thing in the old country, I am told, and are arranged so that everything going out would be in the form of an advertisement. In addition to this, send to all the outside customers and friends, and to those you may wish to reach, cards of invitation, asking them when they come to the city to call, and to make this wine depot or café their headquarters, and have them ask their friends to meet them there. I think that this could be done with very little additional cost, and, if properly managed, would be not only a source of revenue, but one of the best plans of advertising that could be arranged. Get some of the prominent men to go to a place of this kind, and get their opinions, and the rest will follow. All of this will take some time and policy to work, but I am confident that it can be done.

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#### MONEY AND CLIMATE.

At the present time the United States dollar is worth two Mexican dollars, while so far as hotel accommodations and meals are concerned a Mexican dollar in Mexico will go as far as an American dollar in the United States.



We shall be very glad to give you any additional information in our possession if you will only let us know what you desire.

*Daily Temperature in Shade. (1893.)*

Date.	June.			July.			August.			September.		
	Max.	Min.	Med.	Max.	Min.	Med.	Max.	Min.	Med.	Max.	Min.	Med.
1.....	84	57	70	68	55	61	72	54	61	71	54	61
2.....	79	62	68	68	55	60	74	53	63	70	53	59
3.....	76	58	65	71	53	61	74	57	64	72	53	61
4.....	73	55	63	73	55	62	78	56	64	72	52	61
5.....	73	55	63	73	54	61	75	56	63	72	55	62
6.....	69	55	60	73	55	62	75	55	63	75	55	64
7.....	59	54	55	74	54	62	75	56	63	75	55	65
8.....	68	52	58	59	54	55	70	54	63	77	56	65
9.....	72	55	49	67	53	59	77	55	65	76	54	64
10.....	74	57	63	68	55	59	76	55	64	74	51	62
11.....	72	56	63	72	54	62	75	55	63	76	50	62
12.....	75	55	64	72	52	61	72	55	62	73	50	62
13.....	79	56	64	72	54	61	75	56	63	74	48	60
14.....	76	56	65	71	55	61	72	56	61	73	51	61
15.....	78	57	66	67	55	59	67	56	62	72	57	62
16.....	75	56	65	68	55	60	69	56	61	71	54	61
17.....	75	56	65	68	54	60	73	55	63	71	53	60
18.....	73	53	64	72	55	62	73	55	62	71	55	62
19.....	76	55	64	69	54	60	73	55	62	73	55	62
20.....	74	55	64	68	52	60	73	55	62	71	54	60
21.....	79	55	64	68	53	59	75	55	64	71	55	61
22.....	74	56	63	75	53	61	75	51	63	71	55	62
23.....	73	55	62	68	55	60	75	54	64	68	52	60
24.....	75	55	63	72	53	62	74	55	64	67	55	61
25.....	74	55	64	74	54	62	73	55	62	70	55	61
26.....	77	54	63	75	53	61	74	57	63	66	55	59
27.....	74	56	63	71	54	61	74	53	62	70	54	61
28.....	73	56	62	77	53	63	72	53	65	73	53	61
29.....	69	56	61	71	55	62	73	55	61	73	54	62
30.....	72	55	61	79	56	64	75	54	62	73	55	63
31.....				73	63	62	70	55	62			

Yours, truly,

E. A. WHITE.

**FREIGHT RATES ON FOREIGN WINES TO CITY OF MEXICO.**

[Copy.]

CITY OF MEXICO, July 18, 1894.

*Mr. W. J. PARKER, San Francisco, Cal.:*

DEAR SIR: In reply to your favor of the 27th of June, regarding freight rates on foreign wines to the City of Mexico. The last shipments brought in from Barcelona were charged for at the rate of 8 pesetas per 100 liters, plus 10 per cent primage, to Tampico. From Cadiz the charge was 60 pesetas per cubic meter, plus 10 per cent primage, to Tampico. From Bordeaux the charge was 50 francs, plus 15 per cent primage, per Bordeaux ton, to Tampico. Our rate is, as I have already stated, \$33 35 (Mexican silver) per 1,000 kilos, Tampico, ship's side, to City of Mexico.

Yours truly,

A. L. VAN ANTWERP,

A. G. F. A.

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APPENDIX F.

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TARIFF OF VARIOUS COUNTRIES.

PREPARED BY WINFIELD SCOTT.

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# TARIFF OF VARIOUS COUNTRIES.

SAN FRANCISCO, September 1, 1894.

The following is a table showing the import duties of various countries on viticultural products, prepared for the guidance of the export trade, with the assistance of the Consuls-General or Consuls at San Francisco, to whom due acknowledgment is due.

WINFIELD SCOTT,  
Secretary.

## ENGLAND AND HER COLONIES.

### ENGLAND.

Wine, in casks or bottles, not over 30° proof .....	1 shilling per gallon.
Wine, in casks or bottles, between 30° and 42° proof .....	2 shillings 6 pence per gallon.
Wine, sparkling, under 30° proof .....	1 shilling per gallon.
Wine, sparkling, between 30° and 42° proof .....	2 shillings 6 pence per gallon.
All wines over 42° proof .....	3 pence additional for each degree.
If sparkling, and in bottles, if not worth over 15 shillings .....	1 shilling per gallon additional.
If over 15 shillings .....	2 shillings 6 pence per gallon additional.
Spirits .....	10 shillings 10 pence per proof gallon.
Spirits, not tested, as in cordials .....	14 shillings 8 pence per gallon.
Spirits, if bottled and in bond .....	3 pence per dozen.
Perfumed spirits .....	17 shillings 3 pence per gallon.
Raisins, figs, fig cake, apricots, plums, prunes .....	7 shillings per hundred weight.

NOTE.—Grape brandy from countries other than France cannot be entered as cognac.

### CANADA.

Wine, up to 26 per cent alcohol .....	25 cents per gallon and 30 per cent ad valorem.
Wine, each degree between 26 and 40 per cent .....	3 cents per gallon.
Wine, sparkling .....	\$3 per dozen and 30 per cent ad valorem.
Brandy .....	\$2 12 per imperial gallon.

### NEWFOUNDLAND.

Claret .....	51 cents per gallon.
Spanish reds and Italian .....	35 cents per gallon.
Malaga .....	35 cents per gallon.
Port and Madeira .....	\$1 65 per gallon.
Hock and Burgundy .....	\$1 per gallon.
Champagne .....	\$3 40 per gallon.
All other .....	15 per cent and 90 cents per gallon.
Brandy .....	15 per cent and \$2 40 per gallon.

### QUEENSLAND.

Wine, sparkling .....	10 shillings per gallon.
Wine, all other .....	6 shillings per gallon.
Brandy .....	14 shillings per gallon.
Brandy coloring, having over 35 per cent alcohol .....	12 shillings per gallon.
Raisins .....	2 pence per pound.

### TASMANIA.

Wine, sparkling .....	10 shillings per gallon.
Wine, all other, in wood .....	6 shillings per gallon.
Wine, all other, in bottles .....	8 shillings per gallon.
Brandy .....	15 shillings per gallon.
Brandy coloring, over 35 per cent alcohol .....	15 shillings per gallon.

## NEW ZEALAND.

Wine, sparkling .....	9 shillings per gallon.
Wine, all other, except Australian, containing less than 40 per cent proof spirits .....	6 shillings per gallon.
Wine, Australian, containing not more than 35 per cent proof spirits .....	5 shillings per gallon.
Spirits in bottles, jars, etc. ....	16 shillings per gallon.
Spirits in bulk, jars, etc. ....	15 shillings per gallon.
Raisins and dried fruit .....	2 pence per pound.

NOTE.—There is a discrimination of 1 shilling per gallon in favor of Australian wine.

## NEW SOUTH WALES.

Wine, sparkling .....	10 shillings per gallon.
Wine, all other .....	5 shillings per gallon.
Brandy .....	14 shillings per gallon.
Brandy coloring, containing over 35 per cent alcohol .....	14 shillings per gallon.
Raisins .....	2 pence per pound.

## VICTORIA.

Wine, sparkling .....	45 per cent ad valorem.
Wine, all other .....	12 shillings per gallon.
Brandy .....	15 shillings per gallon.
Brandy coloring, containing over 35 per cent alcohol .....	15 shillings per gallon.
Raisins .....	3 pence per pound.

## SOUTH AUSTRALIA.

Wine, sparkling .....	10 shillings per gallon.
Wine, all other, up to 35 per cent proof .....	6 shillings per gallon.
Brandy .....	14 shillings per gallon.
Brandy coloring, containing over 35 per cent alcohol .....	14 shillings per gallon.
Raisins .....	2 pence per pound.

## CEYLON.

Claret, bottled .....	1 rupee and 25 cents per gallon.
Claret, bulk .....	50 cents per gallon.
Sparkling wines .....	50 cents per gallon.
All other wines, bottled .....	1 rupee and 50 cents per gallon.
All other wines, bulk .....	1 rupee per gallon.
Spirits .....	4 rupees per proof gallon, and 50 cents for every 10° over proof.

## FIJI ISLANDS.

Claret and Australian wines, bottle or bulk .....	2 shillings per gallon.
All other still wines .....	4 shillings per gallon.
Sparkling wines .....	6 shillings per gallon.
All spirits .....	14 shillings per gallon.

## NEW GUINEA.

Spirits .....	12 shillings per gallon.
Sparkling wines .....	6 shillings per gallon.
Other wines .....	4 shillings per gallon.

## JAMAICA.

All wines .....	2 shillings 6 pence per gallon.
All spirits .....	10 shillings per gallon.

## TRINIDAD.

Wines, sparkling .....	6 shillings per gallon.
Wines, all other, bottled, under 35 per cent alcohol .....	2 shillings 6 pence per gallon.
For each degree over 35 per cent .....	3 pence.
Wines, all other, in wood, up to 22 per cent .....	8 pence per gallon.
Wines, all other, in wood, up to 32 per cent .....	1 shilling per gallon.
Wines, all other, in wood, up to 42 per cent .....	2 shillings 6 pence per gallon.
For each degree above 42 per cent .....	3 pence.
Brandy .....	10 shillings per gallon.

## BERMUDA.

Wine .....	20 per cent ad valorem.
Alcohol and all distilled liquors .....	4 shillings per gallon.

## BRITISH GUIANA.

Wine, not over 26 per cent proof and not over \$2 per gallon .....	50 cents per gallon.
Wine, bottled .....	\$1 per dozen quarts.
Wine, all other .....	80 cents per gallon.
All spirituous liquors .....	\$2 50 per proof gallon.

## CAPE COLONY.

Wine .....	6 pence per imperial gallon.
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## FRANCE.

GERMANY.

GERMANY, WITH COUNTRIES IN ZOLLVEREIN.

## ITALY.

RUSSIA.

SPAIN.



## DENMARK.

Wine and fruit juice, unfortified, in bottles .....	13.44 cents per pot.*
Same in barrels .....	2.73 cents per pound.
Grape wine, in casks .....	22 per cent ad valorem.
Grape wine, in stone jars .....	45 per cent ad valorem.
Liquors which cannot be graded .....	13.44 cents per pot.
Same, 8° strength or under .....	50.4 cents per eight pots.
Same, for each $\frac{1}{4}$ degree over 8° .....	1 cent per eight pots.

\*4.7 pots equal 1 gallon.

## SWEDEN.

Wines, all kinds, not exceeding 21 per cent of alcohol .....	15 ore per litre.
Wines, all kinds, between 21 per cent and 25 per cent of alcohol (in casks) .....	30 ore per kilogramme.
Wines, all kinds, between 21 per cent and 25 per cent of alcohol (in other packages) .....	65 ore per litre.
Wines, all kinds, over 25 per cent of alcohol .....	1 krone 50 ore per litre.
Brandy and spirits in casks and made from grapes in any other country than France .....	75 ore per litre of 50 per cent alcohol at 15° C.
Same in other packages (regardless of the percentage of alcohol) .....	1 krone 11 ore per kilogramme.
Raisins .....	14 ore per kilogramme.
No allowance for tare.	

## NORWAY.

Wines, not exceeding 21 per cent alcohol, in casks (16 per cent for tare) .....	11½ ore per kilogramme.
Wines, not exceeding 21 per cent alcohol, in bottles .....	11½ ore per litre.
Wines, between 21 per cent and 25 per cent alcohol, in casks (16 per cent for tare) .....	36 ore per kilogramme.
Wines, between 21 per cent and 25 per cent alcohol, in bottles .....	36 ore per litre.
Wines, over 25 per cent alcohol .....	Same as brandy 100 proof.
Brandy, in bottles .....	1 krone 90 ore per litre.
Brandy, in other packages, 100 proof (16 per cent tare for casks) .....	2 krone 3 ore per litre.
Raisins (20 per cent tare on cases) .....	12 ore per kilogramme.

## BELGIUM.

Alcoholic liquors (distilled) used as beverage, up to 50° strength ; Gay Lussac at 15° C., in casks .....	100 francs per hectolitre.
Same, each degree in excess of 50° .....	2 francs per hectolitre.
Same, in bottles, regardless of strength .....	200 francs per hectolitre.
Wines (subject to Internal Revenue tax of 23 francs per hectolitre) .....	Free.
Wines, over 18 per cent alcohol .....	Excess at the rate for alcoholic liquors.
Raisins .....	25 francs per 100 kilogrammes.

## SWITZERLAND.

Dried raisins for wine making .....	20 francs per 100 kilogrammes.
(N. B.—Dried raisins for wine making pay, besides the duties, an internal tax, to be fixed later.)	
Juice from fruit or berries, evaporated fruit juice, without sugar, with or without alcohol .....	20 francs per 100 kilogrammes.
(N. B.—Subject also to an internal tax, to be fixed later.)	
Wine in casks—natural .....	3.50 francs per 100 kilogrammes.
Wine in casks—artificial .....	12 francs per 100 kilogrammes.
Wine in bottles—natural .....	25 francs per 100 kilogrammes.
Wine in bottles—artificial .....	50 francs per 100 kilogrammes.
(N. B.—Artificial wines pay double the duty of natural wines. The natural wines containing over 15° of alcohol, and the artificial wines containing over 12° of alcohol, pay for each degree above an internal tax of 80 centimes and a supplemental duty of 20 centimes per 100 kilogrammes. Natural wines are considered the products of the fermentation of fresh grapes, without any other admixture.)	
Sparkling wines, in bottles .....	40 francs per 100 kilogrammes.
Spirits of wine and alcohol, in casks, per centesimal degree of pure alcohol measured with the alcoholometer of Tralles .....	20 francs per degree and per 100 kilogrammes.
Brandy and other alcoholic drinks, such as cognac, rum, arrack, etc., which are not liquors in the ordinary sense, that is, which contain neither aromatics nor sugar:	
In casks, per degree of pure alcohol measured with the alcoholometer of Tralles .....	20 francs per degree and per 100 kilogrammes.
In bottles or jars, without regard to alcoholic measures .....	30 francs per 100 kilogrammes.

## TURKEY.

Wines and brandies.....	.8 per cent ad valorem.
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## HAWAII.

Alcohol and other spirits of the strength of alcohol, per gallon.....	\$10 00
Provided that security be given that the same is intended for medicinal, mechanical, or scientific purposes, upon application, in due form, to special licensees, per gallon of 90 per cent proof.....	7 50
All exceeding 90 per cent proof shall pay duty according to its strength. (Laws of 1893.)	
Mythelated spirits, to persons holding licenses, per gallon.....	1 00
Ale, beer, cider, porter, and all fermented drinks not otherwise provided for:	
Per dozen reputed quarts.....	40
Per dozen reputed pints.....	20
Per gallon if in bulk.....	15
Brandy, gin, whisky, and all other spirits or strong water of whatever name or description, and all liqueurs, cordials, bitters, brandied fruits, perfumery, and all other articles of merchandise, sweetened or mixed, containing alcohol or spirits of the strength of 30 per cent or upwards, and not exceeding 50 per cent proof, per gallon.....	3 50
All exceeding 50 per cent shall pay alcoholic duty in proportion to its strength, per degree.....	10
Wines, cordials, and bitters above 21 per cent of alcoholic strength, and all other articles containing alcohol or preserved in alcohol or spirits above that strength and below 30 per cent, unless otherwise provided for, per gallon....	2 00
Sparkling Moselle and Sparkling Hock—	
Per dozen reputed quarts.....	4 00
Per dozen reputed pints.....	2 00
Champagne—	
Per dozen reputed quarts.....	6 00
Per dozen reputed pints.....	3 00
Claret, Rhine wine, and other light wines under 21 per cent of alcoholic strength and not otherwise provided for—	
Per dozen reputed quarts.....	40
Per dozen reputed pints.....	20
Per gallon if in bulk.....	15

## MEXICO.

Wine, red or white, in glass, no allowance for leakage or breakage.....	20 cents per kilogramme (net weight).
Same in wood.....	10 cents per kilogramme (net weight).
All other spirituous liquors under same conditions.....	35 cents per kilogramme (net weight).
Raisins.....	10 cents per kilogramme (net weight).

## SALVADOR.

Red wines.....	5 cents per kilogramme.
White wines (including champagne).....	10 cents per kilogramme.
Brandies.....	60 cents per kilogramme.
Raisins.....	20 cents per kilogramme.
Liquors.....	60 cents per kilogramme.

## NICARAGUA.

Sweet liquors.....	\$.0037 per pound.
Wines of all kind in any style of package.....	.022 per pound.
Wines sparkling, such as champagnes, etc.....	.044 per pound.
Spirits 12° to 25° Carthier.....	.294 per pound.
Spirits above 25° Carthier, by special permit of Government.....	.022 per pound.

## COSTA RICA.

Red or white wines in bottles.....	3 cents per kilogramme (gross).
Red or white wines in bulk.....	5 cents per kilogramme (gross).
Fortified wines in bottles.....	9 cents per kilogramme (gross).
Fortified wines in bulk.....	13 cents per kilogramme (gross).
Liquors (whose introduction is allowed in barrels).....	80 cents per kilogramme (gross).
Liquors (introduced in other packages).....	60 cents per kilogramme (gross).
Cognac and all brandies (in barrels or demijohns).....	80 cents per kilogramme (gross).
Cognac and all brandies (in other packages).....	60 cents per kilogramme (gross).
All dried fruits, including raisins.....	13 cents per kilogramme (gross).

## GUATEMALA.

Red wines for table, in wooden packages .....	12 cents per liter.
Red wines for table, in other packages .....	15 cents per liter.
Generous wines, as Sherry, Muscatel, Malvasia, Malaga, Port, Pedro Ximenez, and others, in whatever packages .....	40 cents per liter.
White wines, any kind, in whatever packages .....	40 cents per liter.
Spumy wines, as champagne and others of the same quality, in whatever packages .....	50 cents per liter.
Vermouth wine, in whatever packages .....	50 cents per liter.
Whisky, in whatever packages, up to 20° Beaumé .....	85 cents per liter.

## COLOMBIA.

Claret, in barrels or demijohns .....	2½ cents per kilogramme.
White wine, in barrels or demijohns .....	5 cents per kilogramme.
All other wine .....	40 cents per kilogramme.
Brandy and distilled liquors .....	40 cents per kilogramme.
Raisins .....	20 cents per kilogramme.

## AUSTRO-HUNGARY.

On wines in bottles or barrels .....	20 florins per 100 kilogrammes (netto).
Sparkling wines in bottles or barrels .....	50 florins per 100 kilogrammes (netto).
Brandy and liquors generally .....	76 florins per 100 kilogrammes (netto).
Raisins .....	12 florins per 100 kilogrammes (netto).

## JAPAN.

Wine and brandy .....	5 per cent ad valorem.
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## URUGUAY.

	Value.	Duty.	
		Percent.	Specific.
Liquors—			
And syrups, all kinds, in casks .....	quart 517		.31
In bottle, from 1 pint to 1 quart .....	bottle 599		.32
In bottles, ½ pint up to 1 pint .....	bottle 299		.115
In bottles, up to ½ pint .....	bottle 115		.0775
Wine—			
All kinds, in bottle or flask, up to 1 litre .....	bottle		.237
One half bottle in proportion.			
Fine, in casks or demijohns, such as Rhine, Port, Sherry, Madeira, Ajerezado, Muscatel, and Burgundy .....	quart 517		.237
Common, in general, in casks or demijohns .....	quart 124		.062











